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CHINESE CONSTITUTIONAL DIFFERENTIATION AND KRETSCHMERIAN TYPOLOGY

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INTRODUCTION

NUMEROUS studies devoted to the problem of constitutional differentiation, either from the clinical or from a more strictly anthropological point of view, have been reported from time to time from the West. Adequate studies along similar lines in the East, however, are as yet almost entirely lacking. This has prompted us to undertake an investigation of the problem of constitutional differentiation among individuals of purely oriental racial stock, in this case the Chinese. It has been considered desirable that the initial approach to this problem be designed to test the general scope and biological significance of certain widely accepted type differentiations based upon concepts derived purely from occidental experience. For this purpose the more or less standardized diagnostic procedures of Kretschmer and his followers have been selected as the basis of this preliminary investigation. The present paper reports the results obtained from applying the Kretschmer temperament scale and the relevant physical measurements to one hundred patients of the Peiping Union Medical College Hospital and the Peiping Municipal Psychopathic Hospital.

The prominence given in recent years to Kretschmer's theory of constitutional typology makes it unnecessary to review the elements of his work here. It is sufficient to recall his basic generalization that there is a distinct biological affinity between the cyclothymic temperament and related manic-depressive psychoses and the so-called 'pyknic' body build on the one hand, and similarly between the psychic disposition of schizophrenics and his 'asthenic,' 'athletic' and various dysplastic body types on the other. While conversely, there is but a weak affinity between schizophrenes and pyknics, and a similarly weak affinity between cyclothymes and asthenics, athletics and dysplastics. Whereas Kretschmer (6) in his earlier statements seemingly recognized the advisability of treating racial and constitutional differentiations as of different categorical order, yet subsequently the implications of biological significance attributed to these allegedly indissoluble and dynamic psychophysical relationships have come to impinge more or less directly on the question of racial differentiations. Granted that satisfactory degrees of objectivity in psychological and physical differentiations can be obtained, interracial studies such as the one herein undertaken should throw important light not only on the validity of Kretschmer's assumption of the universality of these specified mind-body relationships but also on the more general question of the relation of constitution to race.

The orthodox Kretschmerian viewpoint with respect to the relationship between constitution and race seems to be that races are basically made up of adventitious mixtures of the primary Kretschmer constitutional types, provision being made for the fact that in different races one or the other type may come to stand out more prominently than the others. Kretschmer supports this contention chiefly by his observation that the leptosome body-build and schizothyme temperament with related psychoses seems to prevail in the northern or Nordic parts of Germany and adjacent regions, and similarly the pyknic-cycloid constitutional type in the Alpine regions. Other observers soon multiplied examples which tended to support this view. Henckel (3), however, on the basis of investigations among the Nordics of Sweden, early questioned the validity of the Kretschmerian generalization with respect to constitution and race. Stern-Piper (20), Pfuhl (12), Ritterhaus (14) and others on the other hand have at various times explained Kretschmer's constitutional types as being fundamentally racial types; the pyknic-cycloid type being none other than the original *Homo alpinus,*

the leptosome-schizothymic type corresponding to the *Homo nordicus*.

Weidenreich has challenged this latter interpretation; and opposes also, though less emphatically, Kretschmer's concept of the relation of constitution to race. In his *Rasse und Körperbau* (25) Weidenreich reviews a wide range of anthropological data and comes to the conclusion that there are only two fundamental constitutional types, the leptosome and the eurysome. This latter type, in spite of frequent assumptions to the contrary is *not* to be considered as equivalent to Kretschmer's specifically defined pyknic type. Weidenreich considers these two types, leptosome and eurysome, as merely the extreme or contrasting forms which have a tendency to run through all races, and his basic conclusion is that constitutional type differences are independent of and do not coincide with differences in race. He suggests that certain proportions of these two constitutional types may become fixed in a population which lives for some time under similar conditions, these constellations of physical tendencies then becoming the racial traits of that population. Detailed reviews of comparative data referring to the distribution and assumed racial relationships of Kretschmer's classic constitutional types in western nations have been given by Perelmann and Blinkow (11), Max Schmidt (18), Georgi (2), Klineberg (4) and others, and will not be recounted here.

In the Far East Shirokogoroff (19) has made several interesting observations on types in China, without however making specific applications of the Kretschmer criteria of typology. Wagenseil (24) made a detailed analysis of a somewhat limited number of physical measurements on 250 Chinese males in Shanghai. Within this group it would appear at first glance that a convincing demonstration is made of the existence of distinct 'leptosome,' 'muscular,' and 'eurysome,' builds, which Wagenseil considered comparable to Kretschmer's physical types. It must be mentioned, however, that Wagenseil's type differentiations were apparently based largely on purely subjective somatoscopic appraisals, his limited number of isolated measurements being rather accessories to the fact. Although Wagenseil's results as far as the incidences of the Kretschmer types are concerned must therefore be judged on a slightly different basis than differentiations more objectively arrived at nevertheless his work as a whole has the very definite merit of calling attention to the relative leptosomatic tendency, the 'Grazilität,' of the Chinese.

In addition, two contributions to the problem of constitution in oriental groups have come from Java. Travaglino (22) provides a certain degree of confirmation of Kretschmer's classification. Although measurements are given in detail Travaglino, however, emphasizes the point that a satisfactory typing of the Javanese from the physical standpoint can be made only by a combination of subjective and objective methods of diagnosis; namely observations, measurements, and photographs. The subjective element is conspicuous throughout his diagnostic procedure. From the total impression obtained it is stated that pyknic types exist, although in less number than in Germany. The Javanese psyche is described as bearing a strong schizoid stamp; shy, timid, unsociable, restrained, irritable-apathetic rather than cheerful-sad in mood. The schizophrenic patients are predominantly leptosomatic. There is accordingly not only a pathological but also a racial confirmation of an affinity between asthenic body build and schizoid temperament in Java. The data given by Travaglino supporting the assumption of an affinity between pyknic physiques and circular psychoses on the other hand is not wholly convincing. This is due in part to the small numbers of cases in this grouping. The most that can be said is that out of 6 circular psychoses in men there was 1 pyknic and 3 mixed forms each of which contained a pyknic element. It may be noted that 5 pure pyknics and 3 mixed pyknics were found among 67 male catatonic patients. This work is again quoted in Germany as confirmation of Kretschmer's findings; but here it must be noted that the agreement is heavily weighted toward the astheno-schizoid affinity which appears to be a rather dominant racial characteristic of the Javanese.

Van Lienden (23) observed and tested psychologically 19 eurysome, 19 leptosome and 62 mixed forms among the Javanese. His physical determinations were based largely upon Pignet's index. His psychological tests included two-point discrimination, the 'blinding test' for retention of a faint perception in the face of a bright light, an association test, color preference, fantasy (Heilbronner pictures), observation of rows of colors (for splitting of attention), and ability to note the order and color of twenty-four objects of four colors, arranged in three rows. Van Lienden concluded that eurysome Javanese give psychological reactions which are in nearly complete agreement with those obtained on pyknic-cycloid Europeans, and that leptosomatic

Javanese show reactions similar to those of leptosomatic-schizoid Europeans.

The relatively large part played by subjective factors in arriving at the results thus far reported for the Orient must be kept in mind. In order to avoid the criticisms implied on this account particular care has been exercised in the present study to deal throughout as rigidly as possible with strictly objective methods and findings.

MATERIAL AND PROCEDURE

One hundred male subjects were selected for the detailed investigation and report presented herein. The selection was made irrespective of physique or of clinical diagnosis, purely on the basis of the thoroughness of their psychiatric and social histories or the completeness of the personality studies and agreement among the authors as to valid psychological classification.

The majority of the subjects were natives of North China, with ages ranging from 19 to 45 years. They were recruited from three sources: 34 from the Peiping Municipal Psychopathic Hospital, 50 from the neurological division and 16 from the general medical and other services of the Peiping Union Medical College Hospital. The degree of education and grade of intelligence of the patients was on the whole rather low. Among the 21 soldiers in the group, 12 were illiterate, the rest having had from one to four years of study either in a government school or with a private tutor. Two-thirds of those of the coolie class had received little or no education. Most of the students came from junior or senior middle schools, only four being college students. The diagnoses of the patients from the Psychopathic Hospital included 14 schizophrenic psychoses, together with several with schizoid background and 5 who had recently recovered from manic attacks. The neurological patients included transverse myelitis, combined degeneration, syphilis of the central nervous system (without behavior change), encephalitis, tumor of the nasopharynx, etc. The medical patients, selected purely on grounds of their being convenient subjects for character analysis, ran the gamut of such diagnoses as acute bronchitis, diabetes, kala azar, secondary anemia, beriberi, psoriasis, leprosy, paroxysmal hemoglobinuria, etc. A summary of the occupational and diagnostic classes of the 100 subjects is given in Table 1.

The nature and scope of the present investigation called for close adherence to the Kretschmer scheme of psycho-physical constitutional

typing. On the psychological side the execution of this plan was greatly facilitated by one of the senior authors (R. S. L.) and his students having already devoted considerable attention to the problem of eliminating whatever racial bias may exist in the original Kretschmer temperament scale (7). The final application of this scale to the Chinese subjects was made therefore with a certain degree of assurance that it was the actual substance and not merely the outward form of the test that was being applied. Special concern was given to the sometimes difficult problem of finding the common Chinese equivalents of the respective shades of meanings and significance of the various traits. As a case in point, the Chinese word ordinarily used to express 'depressed' (yu-ch'ou) is used also for worry, and fails to make the distinction between the mood characteristic of the cyclothyme temperament and that of the schizothyme. In practice as an additional safeguard the temperament scale was always read item by item to the subjects, with explanation in case of apparent misunderstanding, so it is believed that as far as possible the answers received carried the proper significance. The English terms and the Chinese equivalents used in the temperament scale are reproduced in Table 2.

In addition to Kretschmer's temperament scale, and the medical and social histories and physical examination, a Thurstone Personality Schedule, an I.Q., and a mental status test were also carried out on all patients. The latter procedure followed with only a few necessary minor modifications the form outlined by Adolf Meyer. No patient was retained in the series unless there was agreement as to type and diagnosis by all criteria.

The physical diagnoses were made independently. As stated in the introduction, in order to avoid as completely as possible any subjective element entering into the differentiation these diagnoses were made on purely anthropometric grounds. For this purpose the combination of indices assembled by Westphal (27) was selected. No single index considered separately is assumed to provide a differential diagnosis sufficiently definite for the purpose in mind. Nevertheless as a group they cover a very wide range of essential measurements, and, when used together to provide a 'combined score' in accordance with the practice of Westphal, it is felt that they provide as satisfactory an objective method of differentiation as is available at the present time. The index of Wertheimer (26) was added to the list on account of its comparative and possible collaborative value. This latter index is of

interest in that it was devised after a critical appraisal by its author of existing indices of the preceding (Westphal) type, and is considered to possess a certain degree of anatomical justification admittedly lacking in the case of some of the others which are in part at least somewhat empirical in value. The list of these seven indices is as follows:

1. *Pignet's Index*:

$$\text{Height} - (\text{Chest-circumference} + \text{Weight})$$

2. *The Chest-Shoulder Index*:

$$\frac{\text{Shoulder-breadth} \times 100}{\text{Chest-circumference}}$$

3. *Andreew's Index (Modified)*:

$$\frac{[(\text{Chest-circumference} + \text{Abdominal girth}) - (\text{Arm-length} + \text{Leg-length})] \times 100}{\text{Chest-breadth} \times \text{Chest-depth}}$$

4. *Marburg Index 'A'* (devised by Hartner and Westphal):

$$\frac{\text{Height of head} \times \text{Hand-breadth} \times \text{Shoulder-breadth} \times \text{Chest-circumference}}{1000}$$

5. *Marburg Index 'B'* (Strauss and Westphal):

$$\frac{\text{Height of body} \times 10{,}000}{\text{Chest-breadth} \times \text{Chest-depth} \times \text{Anterior trunk-length} \times \text{Shoulder-breadth}}$$

6. *Marburg Index 'C'* (Strauss and Westphal):

$$\frac{\text{Chest-breadth} \times \text{Chest-depth} \times \text{Shoulder-breadth}}{\text{Bisiliac crest-breadth} \times \text{Bitrochanteric breadth}}$$

7. *Wertheimer's Index*:

$$\frac{\text{Leg-length} \times 10^3}{\text{Chest-breadth} \times \text{Chest-depth} \times \text{Trunk-length}} \times 100$$

RESULTS

1. *Psychological differentiation*

Kretschmer contends that the range of temperament gradation represents a continuum, at one end of which is the abstract 'pure cyclothyme' and at the other the abstract 'pure schizothyme.' Since he

TABLE 1

Classification of subjects by source, diagnosis, temperament and physique

SOURCE, DIAGNOSIS, TEMPERAMENT AND HABITUS GROUPS	SOLDIERS	STUDENTS	COOLIES	CLERKS	MERCHANTS	OFFICIALS	MECHANICAL WORKERS	TOTAL	
Source									
Psychop. Hosp. ..	7	4	7	5	2	4	4	33	
Neurol. service ...	6	13	7	4	9	6	5	50	
Medical service ..	8	1	2	4	0	1	1	17	
TOTAL	(21)	(18)	(16)	(13)	(11)	(11)	(10)	(100)	
Diagnosis									
Manic-depressive ..	0	1	1	2	0	0	1	5	
Schizophrenic.....	4	3	1	1	1	2	2	14	
Other psychopathic	5	4	6	3	4	4	1	27	
Organic neurol. ..	3	9	5	4	6	4	5	36	
General medical ..	9	1	3	3	0	1	1	18	
Temperament									
Cyclothyme.....	11	8	11	5	3	4	3	45	61
Cyclo. schizo.	4	4	1	2	1	2	2	16	
Cyclo.=schizo.	1	2	0	2	2	0	2	9	
Schizo. cyclo.	2	2	2	2	2	0	2	10	30
Schizothyme	3	2	2	2	5	3	3	20	
Physique									
Pyknic	0	0	1	0	0	0	0	1	1
Pyknic athletic ...	0	0	0	0	0	0	0	0	
Athletic	2	3	2	1	1	0	0	9	
Lepto. athletic	5	5	6	1	1	1	0	19	90
Leptosomatic.....	14	10	7	11	9	10	10	71	

has made no attempt to standardize numerically the balance between these two tendencies in the case of any individual, there can be only approximate assignments of the various individuals to places on such a temperament scale. In the present study five zones are designated. Subjects who exhibited very nearly equal emphasis in regard to both cyclothyme and schizothyme traits are grouped in a middle zone with a designation $C = S$. No subject in our series appeared as a 'pure type', since in every case at least two or three traits were checked on the opposite side from the dominant one. Individuals showing a clear dominance of cyclothyme tendencies on the one hand or of schizothyme tendencies on the other, are placed respectively at either end of the scale, and designated C or S. Subjects with a majority of cyclothyme traits together with a significant representation of the schizothyme are put in a zone designated as $C > S$; while similarly those with predominant schizothyme but with significant cyclothyme traits are classed as $S > C$.

The distribution of the 100 cases in these five divisions of the temperament scale is given in the next to the last division of Table 1. A very definite pointing toward the cyclothyme end of the scale is clearly evident, the ratio being 61 to 30. This predominance of cyclothymes over schizothymes occurs in spite of the fact that the schizothyme group may be said to be weighted by the presence in the series of 14 outspoken schizophrenic patients, as well as by several 'schizoid personalities' and 'neurasthenic schizothymes'; whereas on the other hand there are only 5 patients from the clinical manic-depressive field. This psychotic weighting of the schizoid end of the scale may raise the question as to whether it is desirable to retain schizophrenic patients of long standing in studies of constitutional types, because there is frequently something of an organic aroma involved in the case of some of these schizophrenics. It cannot always be certain that they have merely blossomed out of a previous schizothyme temperament as is apt to be the assumption. However, after due consideration these schizophrenes were retained along with the non-psychotic schizothymes in the present study as not prejudicial to the purposes in mind. Indeed the inclusion of these cases makes all the more conspicuous the result of the final psychological typing of the cases, namely the ***marked predominance of the number of cyclothymes over that of the schizothymic personalities.***

2. *The racial consistency of the Kretschmer personality scale*

Having arrived at the psychological differentiations on a considerably broader basis than that of the Kretschmer personality scale alone it is possible to make certain corollary observations regarding the relative diagnostic values of the separate traits making up this scale. These observations confirm the not illogical expectation that the choice and combination of traits most characteristic of divergent temperaments in the Orient differ to some degree from those of the West. Thus when

Table 2 **General Temperament Scale of Kretschmer.**

Cyclothyme

Mood and psychaesthesia 气質及心置感覺	T.	C.	S.		Psychic tempo and tension 心置時性及伸縮	T.	C.	S.		Psychomotility. 心置動力	T.	C.	S.		Social attitudes 社交態度	T.	C.	S.	
cheerful 愉快	47	19	2		quick elan 捷智	43	12	4		rich in movement 富於動作	61	17	4		naïvely self-conscious, 純狐	42	6	11	
excited 興奮	43	9	6		busy, 忙	41	11	7		talkative 好講話	32	11	4		arrogantly enterprising, 神氣欲作	63	10	3	
angry 憤怒	36	8	5		full of ideas, 富於構思	46	9	8		loud, 高聲	29	10	6		enjoying life 享受生活	60	17	1	extraverted (directed outward,) 外向
sunny, 歡喜 (happy) (快樂)	62	20	2	warm hearted, 熱心腸	flight of ideas 意念不定	35	3	10	*	(mobile.) (活動)				adequate to situations 適合境遇	understanding 明瞭	61	16	4	realistic, 實物主義
comfortable 安適	64	18	3	good-natured, 好性質	lively, 活潑	31	17	4		free, and easy 自由閒豁	76	18	7		mediating 排解無紛	32	15	3	sociable, 喜交際
quiet 安靜	70	16	9		stimulating 皆發	35	17	3		(quietly heavy,) (靜重)				well-rounded, 圓到	practical 求實主義	73	20	5	open 坦白
agreeable 融合	66	18	4	pleasant 和悅	with flow of energy. 精力飽滿不竭	49	13	2		quiet in movement 動作安靜	53	15	2	*	modest 謙卑	47	10	7	* 坦白
humorous 詼諧	43	13	5		easy-going 從容	56	15	7		poverty of movement 動作缺乏	29	2	12	*	indecisive 猶疑	44	3	14	materialistic 唯物論
good-natured 性質安好	63	19	3		with inertia 帶惰性	25	1	17	*	with smooth motility 動力平順	64	13	14	*					
over-serious 過於認眞	40	9	6		heavy 遲鈍	52	6	16	*										
discouraged 失望	24	3	7	*	dull minded 魯鈍	47	5	16	*										
sad 悲哀	44	4	16	*															
fluctuations of mood:-gay, sad 性情變遷:-快樂悲	40	4	10	*															

Schizothyme

delicate 脆弱	41	2	14		Thoughtless 無思想	26	5	6		flighty 輕浮	29	6	9		idealistic 富理想	55	5	17	
gentle 溫柔	71	12	16		absent-minded, 遲不經心	42	7	11		hasty 急燥	44	8	12		reforming 改革	47	8	6	*
with delicate sensibilities 易感情	65	9	16		impulsive 易衝動	36	5	16		fidgety 坐臥不寧	36	5	7		revolutionary 革命	22	2	2	
irritable 易受刺激 (excitable) (衝慢)	47	6	15		ill-humored 壞脾氣	36	2	13		timid 膽小快	34	1	15		systematically organizing 有序之組織	45	6	6	autistic 自我爲中心
nervous 神經*易感	54	3	17		systematic 有系統	60	9	13		(anxious) 顧慮	43	6	11		capricious 無恒心	22	1	9	directed inwardly, 內向
cool 冷淡	31	0	14		consistent output of energy 精力貫徹一致有序					reserved 保守	41	2	16		eccentric 反常	25	1	9	self-sufficient 自足
strict 嚴厲	34	4	10	serious, without humor. 認眞無詼諧	persistent 堅持	53	12	15		with strained aristocratic bearing 不自然之僵硬	13	2	4	Inadequate to situations 不適合環境	dissatisfied 不滿意	35	2	10	shut-in 密而不宣
harsh 苛刻	10	0	4		constinate 固執	29	5	13		窘促					holding back 不公開	34	2	16	
cold 無情	14	1	5		insistant on detail 吹毛求疵	26	0	6		ill at ease 不能使	25	3	7		suspicious 猜心	36	2	9	
blunt 遲鈍	40	5	15		pedantic 拘泥	12	0	5		awkward 笨拙	20	1	12		solitary 孤獨	23	4	11	
indolent 怠惰	24	1	10		fanatic 執迷不悟	6	0	3		stiff 僵板	12	0	5		shy of people 見人害羞	26	3	6	
										immobile 不表示	42	4	11		misanthropic 厭世離群	24	2	5	
										tacitum 比默	37	3	11		brutally antisocial 暴戾的反社會	9	1	4	
Fluctuations of mood: ecstatic, from pathos to anger, nervous, ill-humored	18	2	5	性情變遷狂喜由激情到憤怒神經過敏壞脾氣	Blocked 阻滯	18	1	6		Blocked 阻滯	18	1	5						

T=total number of answers in whole series of 100 patients.
C=number of answers in group of 20 purest cyclothyme patients.
S=number of answers in group of 20 schizothyme patients.

* Reversals of diagnostic significance.

the results of the questionnaires were reviewed in detail, for the purpose of noting which of the traits, if any, ran through the series in high enough proportion to rank them as racial characteristics rather than indicators of one or the other of the constitutional types, it was found that the designations 'practical', 'free and easy', 'gentle' and 'quiet', (psychological attributes considered by Kretschmer as descriptive of constitutional types) appeared often enough in the answers of our subjects to suggest their representing racial qualities, or at least attributes which all the subjects would like to possess. The incidence for each item is given in the column under *T* in Table 2.

In contrast to these psychological attributes apparently entering more or less in common into the personalities of all the members of the group, traits were next sought which might distinguish the separate types of constitution occurring within the race. In order to choose from Kretschmer's temperament scale the most diagnostic criteria for the cyclothyme and schizothyme temperaments in the case of our Chinese subjects, use was made of the method of internal consistency as described by Thurstone for his Personality Schedule (21). Out of the series of one hundred cases, twenty were selected as representing the most definitely schizothymes. A corresponding group of twenty was then selected to represent the purest types of cyclothymes; the selection in each case being made on the basis of the total evidence available. The number of individuals in the cyclothyme group that indorsed the respective items in the temperament scale is then compared with the number of schizothymes that likewise indorsed the same items. These figures appear in the columns under *C* and *S* in Table 2. It would be expected that Kretschmer's cyclothyme traits, if they proved also of diagnostic significance for the Chinese, would be indorsed by a greater number of the twenty cyclothymes than of the twenty schizothymes, and vice versa for the diagnostic significance of the schizothyme traits. On the basis of the procedure just mentioned, however, thirteen of the total number of one hundred and twelve traits in the temperament scale were found to have actually *reversed* diagnostic significance in this series of Chinese patients. Twelve of these thirteen traits are given by Kretschmer as characteristic of cyclothymes, and yet more Chinese schizothymes indorsed them than Chinese cyclothymes. On the other hand, only one item assigned by Kretschmer to the schizothymes was adopted more frequently by Chinese cyclothymes than by Chinese schizothymes. Of the reversed traits in Kretschmer's cyclothyme list, two fall

in the 'hypomanic' division of the temperament scale, whereas all the rest lie in the 'melancholic' division. It seems that this 'soft-melancholic' division of temperament offers some attraction for many of the Chinese schizothymes. It is interesting that 'reforming' is the single reversed schizothyme trait, indorsed by eight Chinese cyclothymes and six schizothymes.

The considerations leading to the final psychological diagnoses used in the present study were sufficiently broadly based to avoid possible error on account of this element of racial bias in the Kretschmer temperament scale. Although only of corollary interest in connection with the present investigation, this evidence of a certain degree of racial diagnostic inconsistency of the Kretschmer temperament scale, however, merits the careful consideration and perhaps further study of those who may be inclined to place sole reliance on the use of this scale for the psychological diagnosis of Chinese subjects. The proportions of answers made for each item by cyclothymes and by schizothymes in the present instance may readily be seen by comparing the numbers in columns *C* and *S* in Table 2. If a ratio of 2:1 is required in order to give diagnostic value to an item, then 18 traits on Kretschmer's temperament scale fail to qualify. If a 3:1 ratio is adopted, then 28 are undifferentiating, that is, a quarter of the whole list.

Passing to a list of the positive traits exhibited by our subjects, all 20 of the definite cyclothymes selected the traits 'sunny' and 'practical'; 19 added 'cheerful', 'good-natured', 'genial', and 'realistic'; 18 also indorsed 'contented', 'agreeable', 'free and easy', and 'boldly enterprising'. On the other hand seven cyclothyme traits were disowned by the cyclothyme group; namely, 'discouraged', 'sad', 'fluctuations of mood', 'flight of ideas', 'with inertia', 'poverty of movement', and 'irresolute'.

Of the 20 schizothymes, 19 were 'dissatisfied'. The rest of the schizothyme answers were rather scattered; 'harsh', 'fanatic', 'aristocratic manner', 'revolutionary', and 'antisocial' were avoided.

It may be noted in passing that the single patient with typical pyknic physique (*v. infra*) was a coolie, aged 44, who began to feel criticized at work, became sensitive, quit his job, was worried, feared that he would be harmed and grew 'excited' at home. Sexual vitality had been falling off. The reaction-type is regarded as a low-level outbreak in a person of limited interests and intelligence (I.Q. 78), with suspicion, vague restlessness and finally mild panic, near the involutional period

of life. Certainly he was not a typical manic-depressive case, although he indorsed more cyclothyme than schizothyme items on the temperament scale.

3. *Physical differentiation*

The physical aspects of the study involved investigation not only of the extent to which the Kretschmer body types may be objectively differentiated among the Chinese but also the extent to which these types, if differentiated, may be correlated with the psychological differentiations reported above.

The results obtained from applying the selected anthropometric criteria are set forth in Tables 1 and 3 and in Figure 1. Referring to column (*a*) of Table 3, it will be noted that on the basis of the 'combined score' of the six Westphal indices 71 individuals out of the hundred fall outrightly into Kretschmer's 'asthenic' or leptosomatic category of body-build, while 19 others show a dominance of leptosomatic attributes, resulting in a total of 90 of the cases falling in the leptosomatic zone of the physical spectrum. Nine individuals are to be classified in the intermediate group of 'athletics', on the other hand, while only *one* individual is definitely indicated as conforming to Kretschmer's classic type of 'pyknic' body-build. It would thus appear, on the basis of the particular criteria of anthropometric differentiation herein employed, and within the limits of the diagnostic validity of these criteria, that Kretschmer's 'asthenic' or leptosomatic type of body-build constitutes a rather firmly entrenched racial characteristic of the Chinese. It may be remarked parenthetically that this finding is one that might to an extent have been anticipated, in that it is wholly in keeping with our existing knowledge of the outstanding racial characteristics of the Chinese physique. One of the most conspicuous of these is the long, narrow, tubular trunk form, which figures rather prominently in the diagnosis of the leptosomatic type of body-build. This particular skeletal build presents a distinct contrast to both the broad shouldered trapezoid-trunk-form of Kretschmer's athletic type on the one hand, and almost equally, when unobscured by obesity, to the short thick thorax build of the classic pyknic form on the other.

Attention must be directed at this point to the fact that the ponderal element as reflected by the factor of relative adiposity, while not eliminated entirely from the picture in the case of certain of the

TABLE 3

Kretschmer physical type differentiation of Chinese subjects on basis of occidental criteria

COMBINED SCORE		SEPARATE WESTPHAL INDEX DIFFERENTIATIONS 1		2		3			4	5	6	WERTH. 7		PSYCH. DIFF.	
*	(a)	(b)		(c)		(d)			(e)	(f)	(g)	(h)		**	(i)
P	1	3	3	2	2	1	2					8	8	*C*	45
P>A	0	0		0		1						0		*C>S*	16
A	9	2		27		14		*A*	59	20	0	32		*C=S*	9
L>A	19	8	95	24	71	23	84	*A=L*	10	6	0	9	60	*S=C*	10
L	71	87		47		61		*L*	31	74	100	51		*S*	20

COMBINED SCORE			
	90		61
			30

* P = Pyknic; A = Athletic; L = Leptosomatic
** C = Cyclothyme; S = Schizophrenic

Westphal indices, is nevertheless definitely subordinated in general to a consideration of skeletal measurements. Wertheimer has especially stressed the importance of ruling the weight factor out of consideration. Wigert (28) and also Plattner (13), who aside from Westphal and Wertheimer are about the only other workers who have contributed substantially to the problem of the objective anthropometric determination of the Kretschmer body types, likewise make a particular point of eliminating the nutritional element from consideration, on the ground of its being more under the influence of exogenous than of constitutional factors. The anthropometric determinations dealt with herein therefore have to do primarily with certain fundamental body proportions determined by the underlying skeletal framework of the body. We shall return later to the question of the justification (or otherwise) of this rigid elimination of the relative weight factor in constitutional diagnoses. The point here is to recognize clearly that we are dealing in the present instance primarily with body proportions determined almost exclusively by the skeletal framework.

To investigate whether this particular rating on the basis of Westphal's 'combined' score might possibly be the result of a fortuitous

cancelling out of conflicting ratings among the contributory indices the results of the individual index ratings are given in the succeeding columns of Table 3 as well as displayed in graphic form in Figure 1. A survey of the evidence thus analyzed shows, however, that with the exception of index 4, which will be commented on below, the preponderant leptosomatic finding is consistently supported by the various separate indices, including that of Wertheimer. The comparative status of the Chinese physique is particularly well shown in the graphic presentation of the data in Figure 1. In this figure the index averages of the

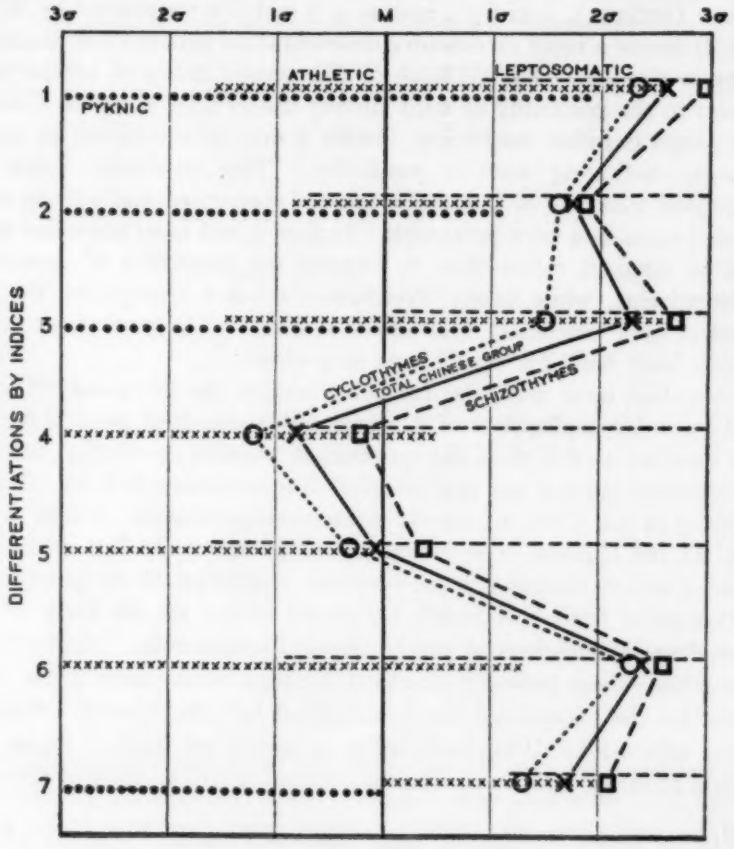

FIG. 1

DEVIATION DIAGRAM OF PSYCHO-PHYSICAL DIFFERENTIATIONS OF CHINESE SUBJECTS ON THE BASIS OF OCCIDENTAL CRITERIA.

Chinese group as a whole, and in addition the psychologically differentiated cyclothyme and schizothyme groups separately, are plotted against the occidental total and respective differential ranges as determined by Westphal.*

Two points stand out clearly in Fig. 1: the first being the relative closeness to each other of the different Chinese group means, and the second the consistency with which all the Chinese group means, with but one exception, fall in the Kretschmer's asthenic or leptosomatic zones of the different index ranges. In view of the considerable overlapping of the 'athletic' and leptosome zones in the case of the first three indices (indices 1, 2 and 3), indices 4, 5 and 6 were devised by Westphal to secure a more satisfactory differentiation between the particular types in question. The evidence of this second group of indices with respect to the possibility of such further differentiation of the Chinese leptosomes is rather conflicting. Index 4 may be considered as rather strongly indicating such a possibility. This particular index, as mentioned above, is of interest in another connection and will be commented upon in a later paragraph. Indices 5 and 6 on the other hand tend to discount rather than to support the possibility of secondary differentiation, while finally Wertheimer's index strengthens the impression of a practically unanimous diagnosis of a generalized leptosomatic body build for the Chinese as a whole.

We shall leave until the following section the discussion of some of the possible implications of this remarkably one-sided physical finding and consider at this place the question of possible correlation between the objective physical and psychological differentiations thus far affected. Keeping in mind the apparently dominant leptosomatic skeletal body-build of the Chinese, it is interesting to glance at the last column of Table 3 which records a quite *reversed* proportion of cyclothymes to schizothymes from that which we would expect on the basis of the Kretschmer postulations of psycho-physical relationships. Any attempt to correlate these basically divergent findings would seem futile were it not for the exceptional results tabulated for the physical differentiations affected by Westphal's index 4 which we marked above for further scrutiny. Here we find a differentiation into 59 cases of Kretsch-

* In the absence of published mean values and standard deviations for the occidental series, these have been approximated from Westphal's graphs; the mid-point and one sixth of the total range being used in each case to represent respectively the mean value and the standard deviation.

mer's so-called 'athletic' type, 10 individuals of intermediate status and only 31 of residual leptosomatic classification. When we compare these figures to those of the 61 individuals of cyclothymic temperament, 9 of intermediate and 30 of schizothymic temperament, we are compelled to note the striking similarity of the figures and to investigate the degree of correlation existing between the two sets of factors involved.

TABLE 4

Contingency table showing distribution of cases with respect to psychological and physical (index 4) differentiations

PSYCHOLOGICAL DIFFERENTIATION	PHYSICAL DIFFERENTIATION: *A*	*A L*	*A=L*	*L A*	*L*
C	34	2	2	2	5
	(44)			(14)	
C S	7	1	1	0	7
C=S	3	1	3	0	2
S C	2	3	1	0	4
	(11)			(15)	
S	4	2	3	1	10

A biseriate distribution of the individual subjects, as is done in the accompanying contingency table, Table 4, makes it possible to estimate, by means of Pearson's contingency coefficient, the probability of this particular distribution being merely the result of chance on the one hand or the result of the existence of a significant relation between the factors involved on the other. The value of the coefficient of contin-

gency calculated in this case is .517. This figure, on the basis of perfect contingency being represented by 1.0, cannot be dismissed as insignificant, although it must be considered as certainly falling considerably short of the Kretschmer ideal of correlation between the psycho-physical factors in question. Closer scrutiny of this distribution as a whole (Table 4) however, raises considerable doubt as to the consistency of the general trend of the correlation among the intermediate cases. In other words, the measure of contingency derived from this irregular distribution would appear to be unduly influenced by the numbers in the corner cells, especially those in the upper left hand corner. Grouping the cases in the four contiguous cells in each corner (figures in parentheses in Table 4), testing thereby the consistency of the intermediate distribution, results in a significant falling off of the contingency measure (.375): the indication being that the intermediate cases fail to show anywhere near the same degree of correlation that should be expected if the corner cell figures constituted a reliable indication of the tendency to be observed throughout the group as a whole. In this connection it must not be lost sight of that it is within this group of intermediate or borderline cases that possible aid in the form of prediction is apt to be most helpful, and that a strong degree of correlation among these cases is more to be desired, certainly from the clinical point of view, than in the case of the exaggerated or well defined individuals found in the corner cells of the table. The fact that the opposite seems to be the case rather argues against the usefulness of this particular index for the diagnostic purpose in mind. The coefficients of contingency for the whole series of indices range from .283 in the case of the second index to the spurious figure .517 just cited for index 4. That for the combined score of the Westphal indices is only .435; that for Wertheimer's index is still lower, namely .394. It is difficult to assign limits of significance to these coefficients of contingency. The figures herein reported fall considerably short of those (some being as high as .8) variously reported by Kretschmer's followers for the occident. None of the figures in the case of our oriental series is sufficiently high to justify much confidence in the indices in question in the prediction of psychological from physical traits or vice versa. The second aspect of the physical side of the investigation, therefore, namely that of a psycho-physical correlation of the kind or degree required to conform to the Kretschmer hypothesis, must be declared not proven.

DISCUSSION

The findings reported above indicate that on the basis of the definitions and criteria herein utilized the larger proportion of our one hundred test cases, approximately two to one, and in spite of a slight degree of unavoidable selective weighting to the contrary, show definite leanings toward the *cyclothyme* end of the Kretschmer scale of temperament distribution. On the other hand with respect to physique the group as a whole exhibits a most conspicuous uniformity of underlying body proportions which classify the individual subjects practically without exception as of *leptosomatic* body-build. Within the framework of the Kretschmer hypothesis, therefore, physique and temperament appear here to be pulled apart.

Not all the possible implications of this finding are immediately discernible. Contrary to expectation, the physical findings seem to afford greater latitude for discussion than the psychological. The most outstanding feature of the physical findings, set forth in Tables 1 and 3 and in Fig. 1, is the almost exclusive concentration of all the Chinese group averages in the leptosomatic divisions of the respective ranges of occidental variability. Attention must be called in passing to the fact that the conclusions derived from the present study are valid only within the limits of validity of the criteria employed, and with respect only to the particular body proportions involved. Neither relative adiposity nor head or face contours, which figure more or less prominently in subjective physical diagnoses, fall within the scope of the present considerations. Regardless of these and other qualifying factors, the findings of the present investigation must be accepted as indicating either a remarkable degree of homogeneity among the Chinese with respect to the particular physical attributes measured, or else a failure of the particular criteria made use of to accomplish the type of physical differentiation sought for. To an extent both these factors enter into the final interpretation of the findings.

Turning first to the question of the relative homogeneity of the Chinese physique with regard to the attributes measured, the evidence in favor of such homogeneity is found in the strikingly one-sided leptosomatic rating of the Chinese group as a whole. Even the single individual classified as 'pyknic' on the basis of the combined score is adjudged leptosomatic according to the proportional characteristics featured by index 6. It seems quite evident that with respect to the particular aspects of physique herein objectively defined the Chinese

exhibit a relative homogeneity not unlike that recognized in the case of their hair and eyes and other prevailing somatic attributes which tend to mask individual differences to a far greater degree than in the case of European peoples. In other words, one phase of the present findings indicates that when unobscured by the variable factor of adiposity the Chinese physique is not only dominantly leptosomatic but exhibits a much higher degree of uniformity of underlying body-build than is observed in the case of Europeans. In Kretschmerian terminology, the Chinese in this respect would appear to be 'less strikingly morphologically differentiated' than the representatives of the occidental racial stocks that have provided the basis of this particular scheme of constitutional differentiation.

Confirmation of this relative homogeneity of the essential body proportions of the Chinese is afforded by a comparison of Chinese standard deviations with those recently published by Morant in his estimation of the relative variabilities of various populations (9). When the Chinese values are inserted into Morant's tables it is found that in the case of all but one (the biacromial breadth) of the twelve body measurements listed the Chinese standard deviations are smaller than those listed for the five other racial groups compared. Even when weighted by the variabilities of ten head measurements, wherein the Chinese variabilities are equal and in some cases greater than those of some of the other groups, the resulting ratings show that the Chinese ratio of total variability is distinctly less than that of any of the European mainland groups listed.

Whether this relative homogeneity of the Chinese body-build is to be attributed to a more nearly direct-line continuation of a single racial stock than is the case among the various European peoples; whether we have in the Chinese an example of a more prolonged and relatively more complete blending of whatever originally diverse strains have entered into their somatic composition; or, whether in the last analysis we are dealing, in degree if not in kind, with a type of difficulty in differentiation commented on by Kretschmer in connection with the generally less distinctly differentiated female body forms—are questions which though interesting are definitely outside the scope of the present study.

However, it is rather the failure of the criteria herein utilized to effect anything approaching the type of physical differentiation found in the occident that constitutes the more practically important finding of

the present investigation. In addition to the generalized morphological considerations just referred to, additional evidence of this failure is obtained from the primary and secondary anthropometric data recorded in Table 5. At first sight these figures might seem to support a superficial judgment contrary to the negative conclusion just stated. In view of the size of the critical ratios of the differences between the group means, and considering the order of the psycho-physical contingency coefficients (in this case based on the undifferentiated total arrays of the physical measurements rather than the differentiated categories as in the case of the contingency coefficients reported above) it might on first thought appear reasonable merely to shift the definitive ranges of the respective diagnostic values to reassigned positions within the ranges of the Chinese distributions, and thus solve the diagnostic difficulty by the establishment of new standard values for the Chinese. What would be lost sight of in such a procedure, however, is that the differential values made use of are already in the form of relative and not absolute values. Furthermore these values were accepted in the beginning as adequately definitive criteria of the types under consideration. Therefore merely to stretch out the Chinese distributions of variables and assign the terms 'pyknic' and 'leptosomatic' to opposite ends of these distributions would in effect be to abandon the quantitative definitions with which the study started.

A more detailed examination of the primary biometric data (Table 5) however reveals several graver diagnostic inconsistencies than those just mentioned. Any array of Chinese anthropometric measurements supports the fact that in spite of the impressive leptosomatic index ratings reported above (these ratings being based chiefly on the dominantly small Chinese chest and tubular trunk form with correspondingly narrow shoulders and hips) the Chinese physique with respect to at least one equally distinctive factor may with practically equal validity be considered basically 'pyknic'. The factor referred to is the relatively long trunk and short legs. This is a well recognized racial characteristic of the Chinese, shared in common with most of the peoples derived primarily from the Mongolian racial stock. The diagnostic importance attached to this distinctly pyknic factor in the Kretschmerian system of typology needs no emphasis here. Attention may likewise be drawn to the indication of an even more significant reversal of diagnostic correlation, namely that the shorter trunks seem on the average to be found more among the cyclothymes rather than among the schizothymes.

TABLE 5

Cardinal measurements and relevant indices, together with critical ratios of differences and psycho-physical contingency coefficients

	GROUP MEANS AND RANGES			DIFFERENCES/P.E. OF DIFFS.			CONTINGENCIES
	(1) Total series	(2) Schizothymes	(3) Cyclothymes	(1)-(2)	(1)-(3)	(2)-(3)	
Measurements							
Stature	167.26 ± .34 (155—182)	165.97 ± .51 (160—180)	167.69 ± .50 (155—182)	2.10	0.73	2.46	.429
Weight	53.84 ± .47 (40—76)	50.40 ± .60 (40—64)	55.82 ± .65 (40—76)	4.51	2.47	6.13	.510
Ant. trunk length	53.34 ± .15 (48—58)	53.13 ± .29 (49—58)	53.40 ± .18 (48—58)	0.64	0.30	0.82	.277
Acromial breadth	36.26 ± .12 (31—40)	35.43 ± .19 (31—39)	36.64 ± .15 (31—40)	3.69	1.98	5.00	.550
Chest breadth	26.22 ± .12 (22—32)	25.37 ± .15 (23—28)	26.80 ± .15 (22—32)	4.42	3.02	6.74	.497
Chest depth	20.12 ± .10 (17—25)	19.80 ± .17 (17—23)	20.39 ± .12 (17—25)	1.62	1.73	2.84	.513
Iliocristal breadth	27.48 ± .09 (24—31)	26.98 ± .14 (25—30)	27.72 ± .13 (24—31)	3.00	1.52	3.87	.486
Chest circumference	79.10 ± .33 (70—95)	76.70 ± .40 (70—83)	80.70 ± .42 (73—95)	4.63	3.00	6.90	.519
Abdominal circumference	70.24 ± .43 (57—92)	66.87 ± .58 (57—80)	72.34 ± .57 (61—92)	4.76	2.94	6.73	.480
Symphyseal height	82.48 ± .23 (74—91)	81.57 ± .36 (74—89)	82.70 ± .33 (74—91)	2.13	0.55	2.31	.455

	(74—91)	(74—89)	(74—91)				

TABLE 5—(*Continued*)

Indices							
Pignet's.....	34.42 ± .72 (—8—60)	39.07 ± .94 (24—60)	31.20 ± .98 (—8—48)	3.93	2.65	5.80	.511
Chest shoulder	46.04 ± .19 (38—55)	46.33 ± .33 (42—55)	45.61 ± .24 (38—50)	0.76	1.40	1.76	.412
Andreew's	—1.10 ± .15 (—9—5.5)	—1.93 ± .28 (—9—2.5)	0.50 ± .18 (—4.5—5.5)	2.61	6.83	7.30	.485
Westphal "A"	50.78 ± .57 (34—78)	46.07 ± .67 (34—56)	53.46 ± .75 (34—78)	5.40	2.86	7.36	.466
Westphal "B"	1.71 ± .02 (1.0—2.4)	1.83 ± .03 (1.4—2.4)	1.64 ± .05 (1.0—2.0)	3.02	1.30	3.09	5.45
Westphal "C"	23.23 ± .20 (17—31)	22.26 ± .35 (17—28)	23.94 ± .26 (18—31)	2.41	2.16	3.85	.492
Wertheimer's.....	296.90 ± 2.66 (170—390)	310.33 ± 4.46 (250—380)	286.15 ± 3.25 (170—360)	2.59	2.56	4.38	.450
Ponderal.....	2.25 ± .01 (2.0—2.6)	2.22 ± .01 (2.0—2.4)	2.28 ± .01 (2.1—2.6)	2.12	2.12	4.24	.479
Skelic	103.00 ± .33 (92—119)	103.80 ± .55 (93—115)	102.90 ± .44 (92—119)	1.25	0.18	1.28	.387

This is distinctly at variance with the postulated Kretschmerian psychophysical relationships with respect to the body proportions in question. Still another diagnostic reversal is found in the fact that our Chinese cyclothymes are found to be if anything distinctly taller than the schizothymes, certainly not definitely shorter as would be expected in accordance with the Kretschmerian theories. While the still further observation that the *cyclothyme* range of variability extends in the large majority of cases over the *entire range of total variability* of the test series, and the general lack of statistical significance (except in the case of Andreew's index) in the differences between the cyclothymic and total means (column 5), argue against this psychological group among Chinese being restricted to a sub-range of the Chinese physical variability.

Although some of these differences in diagnostic significance are small, nevertheless they are sufficiently significant to support the conclusion that from a critical objective viewpoint the answer to the question of whether the Kretschmerian physical types can be identified among the Chinese, at least on the basis of objective anthropometric criteria herein utilized, appears to be in the negative. The impossibility of assigning comparable significance to the types thus determined is clearly demonstrated. And to this extent it must be concluded that it is impossible to apply the Kretschmerian typology in its entirety to the non-European racial stock under consideration.

The conclusion just stated constitutes in a sense the most definite of the various findings of the present investigation. Our interest in the subject as a whole, however, would remain but half served if we allowed the case to rest at this point. In spite of the objective findings just reported, clinical observers in China, especially those with experience in the identification of the types in question in the West, are of the opinion that they have little difficulty in identifying by inspection presumably typical 'pyknic' as well as leptosomatic individuals among the Chinese. Objective measurements therefore seemingly give promise only of complicating the situation. Pyknics by inspection would in a large percentage of cases turn out to be leptosomatic by measurement. As mentioned above, no mere shifting of values or arbitrary reassignment of definitive limits along the newly determined ranges of Chinese variability will quite satisfy the requirements of an alternative interpretation: diagnostic inconsistencies based upon inherent morphological considerations stand in the way of such a simple solution of the dif-

ficulty. The issue seems rather to be one of the acceptance of a subjectively determined pyknicity on the one hand, or of its rejection on the basis of objective anthropometric criteria on the other.

It is not our intention here to enter into a discussion of the relative merits of objectivity versus subjectivity in this particular field of enquiry. Biologists in general, including psychologists and anthropologists, are gradually moving beyond the stage of feeling that the objectivity of other phases of natural science constitutes for them a reproach or a challenge. There is no need therefore to apologize for the subjectivity of phenomena which are none the less real merely because of their subjectivity. The real need is to recognize and accept the phenomena in question for what they are. That Kretschmer's original approach to the problem was almost wholly subjective there can be no doubt. 'Every thing depends', so he declares, 'on a complete, artistic, and sure schooling of our eyes..... The tape-measure sees nothing..... But if we have learned to see, then we shall notice that the calipers brings us exact statements and numerical formulations.' A review of subsequent attempts made by biometrically minded investigators to implement the types in question with exact statements and numerical formulations show that such an accomplishment is in reality far from the relatively simple matter that Kretschmer evidently thought it would be. One of the reasons why such attempts have in general failed to advance very far is that none of the mathematical formulations yet devised is itself free from the taint of a very large element of *a priori* subjectivity. In other words, subjective considerations have controlled the initial definitions and differentiations made use of. The empirically derived numerical formulations thus far proposed have therefore to a large extent merely reflected, and in the last analysis and of necessity only incompletely and inadequately reflected, certain subjectively derived type differentiations of the particular authors concerned.

If we accept as a fact the basic subjectivity of the Kretschmerian typology it is necessary to recognize a more or less inevitable corollary fact: namely, that subjective appraisals of biological concepts in general, although possibly originally composed of relatively simple and easily determinable elements, are apt in their entirety to arrive at a complexity far beyond the range of simple mathematical formulation. Such undoubtedly is the present status of the somatological differentiations involved in Kretschmer's scheme of biotypology. Only a casual ex-

amination of the Kretschmerian concept of pyknicity,* for example, suffices to indicate the wide range of the complex structural traits involved. Westphal seems in a measure to have sensed the fact that no single anthropometric index can possibly embrace more than one or two of the several morphological factors concerned, and has accordingly endeavored to cover this extensive array of variables by employing a whole battery of anthropometric indices. His idea was that from the combined scores of these fractional determinations he would be able to arrive at a satisfactory objective differentiation of the whole. That even this method functions satisfactorily only within the limits of the author's own subjective experience, however, would seem evident from Wigert's failure to obtain comparable results even on similar racial material. The findings of the present investigation confirm the fact that the Kretschmerian concepts of typology in their entirety have grown in complexity beyond the possiblity of satisfactory simple numerical formulation.

Without discounting the value of subjective methods of constitutional appraisal, especially where there are clinical ends in view, nevertheless the question necessarily arises as to just what is actually involved in the differentiations thus arrived at. The essence of subjective comparison, particularly where systematic classification is the object in mind, consists

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*Attention must be drawn to the fact that the term 'pyknic' is subject to differences in meaning. Pearl (10) for instance has qualified his use of the term as follows: "Morphologic variation in man is roughly expressed in terms of the preponderance of the vertical or horizontal dimensions. This leads to the usual classification of body habitus: Asthenic, Intermediate, and Pyknic, which represents a triple division of the continuous frequency distribution having at one extreme individuals in whom the vertical dimensions are a relative maximum and the horizontals a minimum (asthenics), and at the other those in whom this relation is reversed (pyknics)." The writer subscribes wholeheartedly to this idea of continuity in variation with respect to relative preponderance of vertical or horizontal dimensions; although he believes with Weidenreich that the terms 'asthenic' and 'pyknic,' in the sense in which they are used here, could with advantage be abandoned in favor of the more purely morphologically descriptive terms *leptosome* (λεπτος, slender) and *eurysome* (εὐρύς, broad), which are less encumbered with secondary accretions of clinical usage than the terms 'asthenic' and 'pyknic.' However the point is a relatively minor one as long as writers clearly state their meaning and usage of the terms. The term 'pyknic' in the present paper is used purely in the Kretschmerian sense, with all the specific segmental proportional peculiarities that happen to be embraced by the various subjective and objective considerations involved.

mainly of considerations of similarities and agreement; with an unconscious or conscious disregard of differences. Subjective comparisons, furthermore, depend practically entirely on considerations of external body form as contrasted to the less obvious features of internal organization. A careful scrutiny of the methods and results of the differentiations featured in several recent studies involving Kretschmerian type distinctions, to discover if possible a common element underlying the various factors of appraisal, leaves little doubt that the *ponderal* element in some form or other plays a much more influential rôle in the subjective judgment of pyknicity than is generally recognized or admitted. The consistent use by Kretschmer and his followers of Pignet's index as a corroborative measure—wherein weight and chest circumference are combined in such a manner as to reinforce these direct and indirect measures of adiposity—merely emphasizes the dominant rôle the ponderal element plays in the subjective assessments made in the case of the scheme of typology under consideration.

A check-up on Chinese subjects judged 'pyknic' by inspection—except perhaps in the case of Wagenseil's cases where the diagnoses were made partly also on the basis of face and hand considerations—amply confirms the opinion just expressed regarding the influence of adiposity on the subjective diagnosis of this particular body type. It must be admitted that when combined with an ample layer of fat the racially relatively long trunk and short legs of the Chinese invite rather than discourage this particular type designation. Indeed one interested observer, when taxed with the matter of analyzing the factors entering into his subjective judgments of asthenic and pyknic types among the Chinese, arrived at the startling and wholly unjustified generalization that in the case of Chinese of middle age and of sedentary habits ample nutrition and the pyknic body are practically synonomous. In other words, in his opinion the Chinese as a rule are inherently pyknicly inclined, only the absence of adequate or excess food supply in certain sections of the general and institutional populations preventing this fact from being more generally observed. That this conclusion is entirely unjustified may easily be observed in almost any gathering of Chinese among whom no question of food shortage could possibly arise. The statement however serves to emphasize the point that the single factor of relative adiposity may at times play the decisive rôle in the subjective differentiation of Kretschmer's polar body types, especially the pyknic.

THE FACTOR OF ADIPOSITY IN RELATION TO TYPOLOGY

The relation of adiposity to typology is a matter that has already received the passing attention of several investigators. However, with the exception of Davenport who conceived of body-build in terms of genetically determined degrees of corpulency, the question of adiposity in relation to bio-typology has usually been raised only to be discounted. We must insist that the matter merits a more thorough consideration from a slightly different angle than has thus far been accorded it. A certain degree of justification may be claimed for considering two distinct factors of body build to be involved in the Kretschmer concept of typology: one the underlying skeletal build variously subjected to objective measurement, the other a fleshy component still largely a matter of subjective appraisal. To the latter must certainly be attributed those more or less generalized variations in external body form giving rise to certain universally recognized polar types of body form dependent upon relative adiposity.

It must be admitted that a mere distinction between fat and lean individuals over-simplifies a matter that is far from simple. Yet the question of the actual rôle of relative adiposity in such a psycho-physical relationship as that under discussion should be amenable to objective investigation. Inasmuch as individual differences in handling food are known to exist, and inasmuch at these differences are recognized as basically attributable to certain endocrine factors involved in the constitutional make-up, it is not unreasonable to raise the question of a possible relationship between the factors predisposing to fat deposition on the one hand and those underlying the predisposition to the cyclothymic temperament on the other. Such a hypothetical psycho-metabolic relationship should offer no greater difficulties than the assumed psycho-physical relationship effecting a whole host of other somatic peculiarities characterizing, for instance, the classic pyknic body form. Indeed these two relationships, psycho-physical and psycho-metabolic, must in the very nature of things be to an extent mutually inclusive; the latter, if either, probably being the more biologically inclusive of the two.

It is regrettable that the present test series is manifestly unsuitable for such an investigation as that just mentioned for at least two reasons: first the handicap imposed by a very much restricted dietary regime, and second the fact that the average age of the group as a whole (30.9 years) is below that at which the differential weight factor develops to its fullest expression. Both these factors have undoubtedly combined

to depress the contingency coefficient value measuring the relation between the ponderal index and temperament in the present test series. Nevertheless in spite of this handicap if we divide the group in two halves on the basis of the ponderal index we find that approximately *two-thirds* of our cyclothymes occur in the upper or heavier ponderal half, while a like proportion of the schizothymes occurs in the lower half of the ponderal index range. Dividing the range of ponderal variability still further, into quartiles, we find slightly over one-half of the above proportion of cyclothymes falling in the uppermost quartile and a like proportion of the schizothymes in the lowest. Although these figures cannot be considered decisively impressive yet they are strongly suggestive. Combined with the subjective observations reported above they serve to emphasize the need of an adequate investigation of this rather elusive question of the correlation between fat deposition and the Kretschmerian temperament differentiation.

The present trial application of occidentally derived formulations of physical differentiation to the Chinese physique has permitted the examination not only of the Chinese physique but also of the objective anthropometric formulations in question in somewhat wider perspectives than would otherwise have been the case. The results have raised several issues the detailed discussion of which cannot appropriately be undertaken at the present time. Neither the predominantly leptosomatic rating and apparent relative homogeneity of the Chinese skeletal build nor the corollary failure of these objective criteria to effect the differentiation sought for must be accepted as implying that there may not be found other variables to provide the basis of some sort of a type differentiation or classification, if such is insisted upon. There is no reason for believing that the Chinese will prove an exception to the rule that a certain polarity of physical types is almost invariably discoverable, on the basis of some criteria or other, in all but very restricted human populations. The figures listed in Table 5, particularly the relative size of certain of the critical ratios of the differences observed, suggest that the most evident possibilities of such differentiation lie in the direction of Stockard's concepts of linearity versus laterality; or in other words a relative dolichomorphism and brachymorphism corresponding to Weidenreich's leptosome and eurysome types; analagous to Pearl's simplified concepts of asthenic and pyknic forms dependent upon the relative preponderance of the vertical or horizontal dimensions. A survey of the coefficients of contingency listed in the last column of Table 5 suggests

also that the possibility of some sort of a relationship between these relatively simple variants and temperament may be worth further study.

Finally, that this discussion has dealt in the main with the physical aspects of the problem in hand to the almost complete exclusion of the psychological is due merely to the fact that the former have presented at the moment the more tangible possibilities of quantitative discrimination. It is only to be expected that Chinese psychology when similarly subjected to finer dissection, as forecast by Schaltenbrand (17), will likewise show internal structural peculiarities incident upon the psychological conditioning that has come about during the historical experiences of the race. In the meantime the rather inclusive designations of temperament differentiations embraced by the Kretschmerian school of constitutional typology have adequately served the purposes of the present investigation, and the finer dissection mentioned above has not been deemed necessary in connection with the immediate problem in hand.

SUMMARY AND CONCLUSIONS

To summarize: owing to distinctive racial differences in both the kind and range of somatological variabilities, pertaining chiefly to body proportions determined primarily by the skeletal framework, the Kretschmerian system of bio-typology, as based on definitions and differentiations derived exclusively from occidental experience, cannot in its entirety be applied to the Chinese and related peoples of purely oriental racial stock. The impossibility of assigning comparable significance to the objectively determined somatological types in the case of subjects representing the two major racial stocks in question is clearly demonstrated.

On the other hand certain similarities in external body contours amenable to subjective appraisal are undoubtedly to be observed. These, upon analysis, are considered to depend chiefly upon variabilities in body form which in turn depend upon recognized constitutional variabilities in the metabolic factors regulating the deposition of fat. The suggestion is made that the fleshy component of body build with its constitutionally variable factor of relative adiposity is a separate variable whose rôle in the determination of constitutional body types must be considered apart from that of the skeletal element of body build. Studies dealing aggressively with this phase of the subject should pay particular attention to the possibility that the factor of relative adiposity as such, in so far as it can be shown to depend upon a genetic-endocrine-metabolic basis,

may of the two physical factors in question prove to be the more significantly correlated with the psychological variable in the total constitutional ensemble.

Attention is directed to the highly subjective nature of the Kretschmerian somatological differentiations, and to the obstacles that this fact offers to a satisfactory implementation of these concepts with objective formulations. Although certain phases of biological investigation may perhaps always be dependent upon subjective considerations, nevertheless the argument in favor of a greater degree of objectivity in dealing with the somatological aspects of human constitution lies in the fact that the human body is after all not an abstract but a concrete object. The objective anthropometric criteria of Westphal and Wertheimer made use of in the present investigation, although inadequately representing the whole of the concepts they were designed to serve, nevertheless have in the present instance contributed more to a satisfactory comparative knowledge of the Chinese physique than any number of subjective appraisals could have accomplished. Further progress in the direction of investigating the somatological aspects of human constitution, either with or without consideration of alleged psychological correlations, demands more rather than less objectivity. Every effort should be made to conserve and add to the gains already made toward objective concepts and measurements yielding statistically manageable findings. Satisfactory analysis and interpretation of the data involved will require competent handling of the techniques of correlational methods and factor analysis.

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PHYSICAL TYPES OF WEST AFRICAN NEGROES

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THE findings presented in this paper are based on measurements obtained in the course of anthropological field-work in Nigeria, Dahomey, and the Gold Coast during 1931. The subjects, who represent tribes inhabiting the forested coastal belt of West Africa—the habitat of the type designated "true Negro"—were measured at Abeokuta, Southern Nigeria, at Abomey and Allada, Dahomey, and at Kumasi, the Gold Coast. The Nigerian series includes men from the Egba (Yoruba), Egun, and Sobo tribes; that from Dahomey is made up exclusively of Dahomeans; while the Kumasi group, though preponderantly Ashanti in composition, also comprise a few individuals belonging to related Akan tribes that live near the coast.

The measuring was done in the local prisons, since in view of the limited amount of time available during this field-trip for anthropometric investigation, subjects were thus obtained most expeditiously. For permission to do this work I am grateful to the officials of the several colonies, and especially to Captain Lace, Superintendent of Prisons, Southern Nigeria, who allowed me to work in Abeokuta; to Mm. Poirier and Jaton, Commandants, respectively, of the Cèrcles of Abomey and Allada during the period of this research; and to Mr. E. A. T. Taylor, the then Acting Commissioner for Ashanti. It is also a pleasure to record my indebtedness to a fellow worker in the field of anthropology, Dr. Drysdale Anderson, then Medical Officer of Health at Abeokuta, who at that time was engaged in his research into the growth of native children.[1] With the permission of the Director of the Medical and Sanitary Service of Nigeria, Dr. Anderson gave indispensable aid

[1]The methodological problems presented in Dr. Anderson's paper (1933), merit the attention of those concerned with the study of growth and development because of its ingenious attempt to overcome the difficulties inherent in such research among peoples where the exact ages of children are not obtainable.

in the actual taking of measurements of the Nigerian subjects, being responsible for the data as concerns the traits of stature, height sitting, width of nostrils and lip thickness.

The significance of the material to be presented here is two-fold. Those who have worked in the field of Negro anthropometry will realize the paucity of physical measurements available for most regions of Africa. This series, therefore, contributes in some slight measure toward attaining a more precise determination of the physical types of the western coastal areas of the continent. For American students, however, these data also have a broader meaning, since the regions inhabited by the subjects are those from which a considerable proportion of the Negro ancestry of New World Negroes was derived.[2] These measurements may thus be regarded as providing more material of the type needed to give us information concerning the stocks from which the present-day mixed Negroid population of the New World are descended.[3]

I

Table 1 gives the statistical constants for the Dahomean, Ashanti and Nigerian series. Both the tribal similarities and differences are worthy of note. No differences of statistical significance are to be discerned between these populations in stature, height sitting, upper and total facial height, width of nostrils, lip thickness, and height and width of ear. Yet in length and width of head and cephalic index, in bizygomatic width and nasal height, differences that are statistically significant are found to exist between the Dahomeans and the Ashanti; while in pigmentation, which was measured with the color top,[4] differences of significance for all four colors are found between the Nigerian sample and the other two groups, the Dahomeans and Ashanti differing significantly for the black, red, and yellow, though not for the white. Table 2 makes these points clear by giving the differences between the averages of the three series and the mean square variabilities of these differences. The

[2] Cf. Herskovits (1933).

[3] In this connection, the table given by Todd (1929), p. 63, his diagrams on p. 67, and his conclusions may be examined with profit.

[4] A full discussion of the use of the color top and the problems involved in its employment is to be found in Herskovits (1930), pp. 34-38, and in Todd, Blackwood and Beecher (1928). The details of the technique employed measuring the other traits, is to be found in Herskovits, *ibid.*, pp. 18-34.

TABLE 1

Adult male West African Negroes. Comparisons of traits measured on Dahomean, Ashanti, and Nigerian series

TRAIT	DAHOMEY			ASHANTI			NIGERIA		
	N	*M*	$\pm\sigma$	*N*	*M*	$\pm\sigma$	*N*	*M*	$\pm\sigma$
Stature (cm.)	93	168.57	±6.36	77	165.29	±6.07	100	167.12	±6.45[3]
Height sitting (cm.)	93	83.72	±3.47	77	83.62	±3.36	100	84.39	±3.25[3]
Head length (mm.)	93	193.47[1]	±6.99	77	189.25[1]	±5.72	...	.....	...
Head width (mm.)	93	146.55[1]	±4.77	77	149.19[1]	±5.02	...	.....	...
Cephalic index (%)	93	75.85[1]	±3.29	77	78.83[1]	±2.47	...	.....	...
Upper facial height (mm.)	93	66.87	±4.15	77	67.88	±4.37	...	.....	...
Total facial height (mm.)	93	118.81	±6.53	77	118.57	±5.72	...	.....	...
Bizygomatic width (mm.)	93	141.18[1]	±4.80	77	138.65[1]	±5.63	...	.....	...
Height of nose (mm.)	93	50.63[1]	±3.70	77	52.73[1]	±4.02	...	.....	...
Width of nostrils (mm.)	93	43.95	±3.26	77	44.68	±3.20	100	43.54	±2.61[3]
Lip thickness (mm.)	93	25.99	±3.69	77	25.64	±3.72	100	25.06	±3.37[3]
Height of ear (mm.)	93	58.51	±4.47	77	57.00	±4.01	...	.....	...
Width of ear (mm.)	93	33.82	±2.34	77	34.19	±2.52	...	.....	...
Pigmentation (%) N	93	88.64[1]	±2.30	76	90.16[1]	±1.74	100	86.42[1]	±2.79
(outer arm) R	93	7.31[1]	±1.37	76	6.29[1]	±1.17	100	7.98[1]	±1.40
Y	93	2.82[1]	± .95	76	2.37[1]	± .68	100	3.92[1]	±1.36
W	93	1.30	± .45	76	1.21	± .56	100	1.74[3]	± .62
Pigmentation (%) N	92	85.77[1]	±2.76	76	87.63[1]	±2.55	...	.....	...
(inner arm) R	92	8.57[1]	±1.53	76	7.49[1]	±1.46	...	.....	...
Y	92	3.96[1]	±1.18	76	3.10[1]	± .97	...	.....	...
W	92	1.75	± .66	76	1.59	± .78	...	.....	...

[1] Differences are statistically significant.

[2] Differences statistically significant only between Nigerian and other two series; but not between the Dahomean and Ashanti series.

[3] Measurements taken by Dr. Drysdale Anderson, M.O.H., West African Medical Staff.

TABLE 2

Differences between averages of various traits studied in component series of West African Negroes, plus or minus the mean square variabilities of these differences

TRAIT		DAHOMEY-ASHANTI Diff.	±$\sigma_{Diff.}$	D / $\sigma_{Diff.}$	DAHOMEY-NIGERIA Diff.	±$\sigma_{Diff.}$	D / $\sigma_{Diff.}$	ASHANTI-NIGERIA Diff.	±$\sigma_{Diff.}$	D / $\sigma_{Diff.}$
Stature		2.28	± .96	2.38	1.45	±.92	1.58	—1.83	±.94	1.95
Height sitting		.10	± .52	.19	— .67	±.49	1.37	— .77	±.50	1.54
Head length		4.22	± .95	4.44[1]	...	...	...	...	...	...
Head width		—2.64	± .30	3.57[1]	...	...	...	...	...	...
Cephalic index		—2.98	± .45	6.62[1]	...	...	...	...	...	...
Upper facial height		—1.01	± .65	1.55	...	...	...	...	...	...
Total facial height		.24	±1.28	.19	...	...	...	...	...	...
Bizygomatic width		2.53	± .81	3.12[1]	...	...	...	...	...	...
Height of nose		—2.10	± .59	3.56[1]	...	...	...	...	...	...
Width of nose		— .73	± .50	1.26	.41	±.44	.91	.14	±.48	.29
Lip thickness		.35	± .57	.61	.93	±.51	1.12	.58	±.55	1.23
Height of ear		1.51	± .54	2.79	...	...	...	...	...	...
Width of ear		— .37	± .37	1.00	...	...	...	...	...	...
Pigmentation (outer arm)	N	—1.52	± .32	4.75[1]	2.22	±.37	6.00[1]	3.74	±.35	10.7[1]
	R	1.02	± .20	5.10[1]	— .67	±.20	3.35[1]	—1.69	±.20	8.45[1]
	Y	.45	± .14	3.21[1]	—1.10	±.17	6.47[1]	—1.55	±.17	9.12[1]
	W	.09	± .078	1.15	.44	±.078	5.51[1]	— .53	±.084	6.31[1]
Pigmentation (inner arm)	N	—1.86	± .41	4.54[1]	...	...	...	...	...	...
	R	1.08	± .24	4.50[1]	...	...	...	...	...	...
	Y	.86	± .16	5.39[1]	...	...	...	...	...	...
	W	.16	± .11	1.45	...	...	...	...	...	...

[1] Difference is statistically significant.

ratio between each difference and its variability is also presented, thus indicating the degree to which a given difference may be regarded as of significance.

If these results be analyzed, it is first of all to be remarked that in stature and height sitting the population of this region of West Africa is relatively uniform. The differences in cephalic measurements between the Dahomeans and the Ashanti, however, are somewhat puzzling, until the relevant variations in social usage with respect to these traits are analyzed. In Dahomey, no opinion concerning any concept of beauty as related to head-form was heard, though a considerable period of time was spent among the Dahomeans. On the contrary, only a short stay in the Gold Coast was needed to make clear the feeling concerning the desirability of short- as against long-headedness. When it is understood that the heads of Ashanti infants are subjected to pressure during the early months of life, the significantly shorter head of the Ashanti, apparent in the comparative figures, becomes readily understandable.

Turning to the measurements of the face, a number of results appear which call for explanation. That upper and total facial height of the Dahomeans do not differ significantly from these traits in the Ashanti would again seem to indicate a basic unity of stock, were it not for the fact that the notorious unreliability of the land-marks which determine these measurements makes it unsafe to draw conclusions from them, even where the technique is that of a single observer. The findings concerning facial width also present a curious inconsistency, for though the head-measurements of the Ashanti show a greater average width for this population, a trait as closely related to it anatomically as facial width gives just the opposite result. The significance of the difference between these two populations in nasal height is also not without interest. A possible reason for this which comes to mind involves the historic contacts between the inhabitants of the subdesert region to the north and the coastal folk, these having been far more frequent in the case of the Ashanti than in that of the Dahomeans.[5] Unfortunately for this hypothesis, however, comparison of the averages for this trait in the Ashanti with those of Tremearne's and Weninger's northern Nigerians given in Table 3, and with the average for nose-height on the Hausa series measured by Tremearne (1911), which is 47.22 mm., would seem to show that the nose among these more north-

[5] Cf. Herskovits, 1936.

TABLE 3

Comparative measurements of West African and Congo Negroes

TRAIT	ASHANTI (Rattray-Buxton)			NIGERIANS (Talbot-Keith)			EKOI (Mansfeld)			KAGORO (Tremearne)			KAJJI (Tremearne)			WEST AFRICAN (Weninger)			CONGO NATIVES (Torday-Keith)		
	N	*M*	±σ	*N*	*M*	±σ	*N*	*M*	±σ	*N*	*M*	±σ	*N*	*M*	±σ	*N*	*M*	±σ	*N*	*M*	±σ
Stature (cm.)	47	164.21	±5.53	55	169.36	±8.36	20	166.86	±5.83	37	160.11	±5.55	30	168.3	±8.57	...	.....	....	63	168.51	± 7.27
Height sitting (cm.)	..	.....	....	..	.....	....	19	85.97	±3.07	37	86.51	±3.00	30	84.4	±3.94	...	.....	....	..	.....	....
Head length (mm.)	48	187.33	±4.66	54	193.12	±5.31	19	191.05	±4.11	72	188.19	±6.12	55	192.31	±6.72	100	191.35	±6.77	63	187.67	± 7.12
Head width (mm.)	48	145.01	±4.41	54	146.41	±5.95	20	143.16	±5.42	72	142.43	±4.07	55	144.56	±4.66	100	142.50	±5.27	63	147.53	± 6.43
Cephalic index (%)	48	77.52	±2.47	54	75.83	±2.96	19	75.26	±3.27	72	75.78	±2.79	55	75.17	±3.07	100	74.62	±3.21	63	78.30	± 4.06
Upper facial height (mm.)	48	59.89	±4.48	55	61.24	±5.48	20	54.75	±4.10	..	.....	....	..	.....	....	100	66.78	±5.19	58	61.69	± 5.14
Total facial height (mm.)	48	108.29	±5.87	..	.....	....	20	114.45	±6.82	72	112.04	±7.52	..	.....	....	100	117.75	±7.15	..	.....	....
Bizygomatic width (mm.).	48	134.67	±4.28	53	139.60	±6.22	20	139.05	±3.94	72	136.96	±4.05	55	139.49	±5.03	100	137.33	±5.44	63	136.22	±10.19
Height of nose (mm.) ...	48	45.17	±2.48	55	45.31	±3.78	20	47.05	±2.76	72	47.93	±4.01	55	49.22	±3.84	100	48.00	±3.92	63	44.75	± 4.54
Width of nostrils (mm.).	48	42.48	±3.20	54	44.54	±3.71	20	43.95	±2.18	72	44.41	±2.78	55	45.51	±2.83	100	44.17	±3.29	63	43.05	± 3.30
Lip thickness (mm.)	48	.....	....	..	.....	....	20	25.60	±3.73	..	.....	....	..	.....	....	...	.....	....	..	.....	....
Height of ear (mm.)	..	.....	....	..	.....	....	20	59.55	±3.96	..	.....	....	..	.....	....	100	56.18	±4.07	..	.....	....
Width of ear (mm.)	..	.....	....	..	.....	....	20	35.6	±3.24	..	.....	....	..	.....	....	100	32.44	±2.36	..	.....	....

erly folk is lower than in the case of either the Ashanti or the Dahomeans.[6]

Several explanations of the differences in pigmentation between the three series may be made. As has been stated, the differences in black, red and yellow are statistically significant between all the populations represented. Yet can differences that are statistically significant always be regarded as actually so? In studying American Negroes, my own average observational error for the black segment of the color top, based on repeated measurements of forty-eight individuals, was found to be 3.2 per cent; for red, it was 2.15 per cent; for yellow, 1.19 per cent and for white, 1.44 per cent. If Table 2 be again consulted, it will be found that in the case of the outer arm, only the differences in black and yellow between Ashanti and the Nigerians are larger than these figures for average observational error, while for the inner arm in no case do the differences (between Dahomeans and Ashanti) even approximate them. The points that come to mind as to the reality of these apparently significant differences, and as to the usefulness of the color top except for indicating degrees of darkness, are reinforced when personal impressions of the skin-color of the tribes under consideration are recalled, for the distinctly reddish tinge of the Dahomean skin is most striking to an observer whose experience with Negroes has been largely confined to those having brown (or "black") skins. Certainly this trait would never be suspected from the statistical findings, for the percentage of red in the Nigerian readings of the color-top is significantly greater than that in the Dahomean, despite the fact that the Nigerians are distinctive for the darkness, rather than the reddishness of their skins! It is true that the percentage of red is greater for the Dahomeans than for the Ashanti, but this merely adds confusion to the results, and indicates the need for further study, by means of a more satisfactory technique, of this important trait among the Negroes of West Africa.

The results presented in Table 1 are to be compared with those given in Table 3, where are to be found constants already published for other West African series, or derived from raw data accompanied by inadequate statistical analysis. Thus for the measurements of Nigerians by Talbot and of Congo natives by Torday (Keith, 1911), of the Ekoi (Mansfeld, 1908), and for the Kajji and Kagoro of northern Nigeria

[6] The question of technique of measurement employed by the various observers also enters here as a crucial point, raising an issue that unfortunately cannot be resolved on the basis of the data at hand.

(Tremearne,1912), necessary recomputations were made. The statistical constants for the Ashanti measurements taken by Rattray, however, are given as published (Buxton, 1923), as are those for Weninger's West African series (1927).

No striking differences exist between the Ashanti measured by Rattray and the present series except in those traits which involve the location of the illusive naso-frontal suture,—upper and total facial height, and height of nose. In these the differences are considerable, but, in view of the similarities both in averages and variabilities between the measurements of other traits for the two series, this must be put down to measuring techniques. The Nigerians measured by Talbot and presented by Keith represent twenty-three Nigerian Ekoi, ten Kabila, thirteen Korawp, and nine males from assorted tribes of the Niger Delta. Between this group, the Cameroon Ekoi measured by Mansfeld, and the Nigerians of this study, no differences worthy of comment are to be found. As has been stated, the Kajji and Kagoro measured by Tremearne, and Weninger's West African series represent peoples living north of the forested coastal belt where the present series are located. The short average stature of the Kagoro, the relatively high variability of this trait among the Kajji, and the smaller ear size of the assorted tribesmen measured by Weninger represent the outstanding differences between these series and those measured in the course of this research. As for the Congo natives measured by Torday—twenty Bushongo, eleven Basoko, ten Santo, and twenty-four men from miscellaneous tribes of the area,—their most distinctive characteristic is high variation in all measurements, something which would seem to corroborate the large differences in physical traits among the "Bantu" peoples that has often been remarked, and would seem further to underline the difference in this respect between them and the more homogeneous West African "true Negro".

II

To facilitate the comparison of these West Africans with New World Negroes, the three constituent groups were combined into a single series, the statistical constants for which are given in the first column of Table 4. This was done despite the significant differences between the individual series, since in all the New World there has been constant mixture of these aboriginal Negro stocks not only with the European and indigenous Indian populations with which they have been

in contact, but with one another. The traits in which differences exist between the component series are indicated, however.

Since the completion of my research on the physical form of American Negroes in 1927 (published in 1930), the only further studies available are those of Davenport and Steggerda on Jamaican Negroes (1929), of Herskovits, Cameron and Smith on Negroes from Amory, Mississippi (1931), and of Day (1932) on a population of mixed Negro-White families from the upper economic strata of the American Negro population. The results of all these studies in comparable traits are included in Table 4, except in the case of the last cited. Mrs. Day's results have not been utilized because of the shortness of her series of adult males in any given category of mixture, and more especially because the majority of individuals represented in it had so small a proportion of Negro ancestry that only in a sociological sense are they to be regarded as Negroes at all. In addition to the constants for the total series of American Negro males measured in the course of my earlier study, those for the sub-group of that series entitled "unmixed Negro", the members of which in their genealogies stated that they knew of no crossing with Whites or Indians, are also included.

Turning to the materials themselves, the West Africans are found to be shorter, both in stature and height sitting, than any of the New World series. The most likely explanation for this is to be sought in the historic fact of racial mixture, since the West African true Negro is short and stocky as against the taller European with whom he has for the most part crossed in the New World. In view of this the slight difference in variability found between the West African and the several New World Negro series is worthy of mention. In cephalic index the differences between the Old and New World groups are relatively small except in the case of the Western Reserve University series (Todd, 1923), where an apparent difference is explained by the fact that the index was computed from measurements on the skull. It is to be noted in this connection that averages for length and breadth of head of Western Reserve University cadavera (Todd and Lindala, 1928), differ only slightly from the other series.

In both upper and total facial height, the averages for West Africans are distinctly lower than for American Negroes, but because of the unreliability of the land-marks involved in these measurements, no conclusions should be drawn from this fact. The same is true for nasal height. Here, though there is a substantial agreement between the

TABLE 4

Comparison of West African male Negroes with various New World Negro series

TRAIT	WEST AFRICAN MALES — *Total Series* (Herskovits)			U. S. NEGRO MALES — *Total Series* (Herskovits)			U. S. NEGRO MALES "N" — *Genealogical Class* (Herskovits)			AMORY SERIES — *U. S. Negro Males* (Cameron)			W. E. U. SERIES (Todd and Lindala) (Todd) (Todd and Van Gorder)			JAMAICAN NEGRO SERIES (Davenport and Steggerda) — *"Blacks"*			*"Browns"*		
	N	*M*	±σ	*N*	*M*	±σ	*N*	*M*	±σ	*N*	*M*	±σ	*N*	*M*	±σ	*N*	*M*	±σ	*N*	*M*	±σ
Stature (cm.)	270	167.54	±6.30	887	170.5	± 6.40	102	170.4	± 5.65	156	171.0	± 7.71	100	174.4	±6.10	54	170.60	±6.76	93	170.17	±6.75
Height sitting (cm.)	270	84.00	±3.45	840	87.7	± 3.50	102	87.3	± 3.1	...	.....	...	100	88.6	±3.19	51	87.97	±3.37	93	87.70	±3.63
Head length (mm.)	170	191.56[1]	±6.63	961	196.5	± 6.51	109	197.97	± 6.5	156	195.7	± 6.67	100	192.6	±6.08	50	193.30	±6.84	92	191.62	±6.44
Head width (mm.)	170	147.75[1]	±5.06	961	151.4	± 5.74	109	151.9	± 5.2	156	148.0	± 5.45	100	148.9	±6.10	51	149.91	±4.42	93	149.27	±5.16
Cephalic index (%)	170	77.14[1]	±3.27	961	77.1	± 3.45	109	76.9	± 3.2	156	75.7	± 3.18	87	74.9	±3.19	54	77.38	±2.76	93	77.95	±2.80
Upper facial height (mm.).....	170	67.33	±4.28	538	71.3	± 4.06	108	71.7	± 4.0	156	72.8	± 5.04	100	71.2	±5.56	..	.....	...	..	.....	...
Total facial height (mm.).....	169	118.69	±6.19	534	122.6	± 6.31	108	123.9	± 5.6	156	122.5	± 7.88	100	125.3	±7.63	..	.....	...	..	.....	...
Bizygomatic width (mm.).....	170	140.04[1]	±5.36	956	139.2	± 5.92	108	140.7	± 5.4	156	138.5	± 5.20	100	139.0	±6.09	..	.....	...	..	.....	...
Height of nose (mm.)	170	51.58[1]	±3.97	960	53.4	± 3.75	109	53.1	± 3.2	156	52.6	± 4.70	100	51.4	±4.84	42	48.31	±4.09	80	48.44	±3.55
Width of nostrils (mm.).....	270	44.00	±3.04	961	40.9	± 3.99	109	43.4	± 2.8	156	41.5	± 4.35	100	42.4	±3.68	51	45.82	±2.75	93	42.61	±3.44
Lip thickness (mm.) (center)	270	25.54	±3.61	959	21.2	± 4.50	109	23.9	± 4.2	156	21.0	± 5.14	100	21.1	±4.92	..	.....	...	..	.....	...
Height of ear (mm.)	170	57.84	±4.33	959	60.7	± 4.32	108	59.8	± 4.6	156	59.7	± 5.13	100	61.6	±4.55	52	58.21	±3.96	92	58.01	±4.32
Width of ear (mm.)	170	33.99	±2.35	960	33.8	± 2.69	108	33.8	± 3.2	156	33.5	± 3.12	100	37.6	±3.03	52	33.27	±2.77	91	32.95	±2.78
Pigmentation (%) N	269	88.28[1]	±2.89	593	66.65	±13.98	109	75.5	±10.3	156	76.9	±10.72	97	82.79	±6.11	..	.....	...	..	.....	...
(outer arm) R	269	7.28[1]	±1.50	593	12.4	± 2.84	109	10.8	± 2.9	156	9.2	± 4.27	97	7.61	±2.51	..	.....	...	..	.....	...
Y	269	3.10[1]	±1.25	593	10.8	± 4.66	109	7.8	± 3.6	156	6.35	± 3.36	97	4.98	±2.25	..	.....	...	..	.....	...
W	269	1.44[2]	± .60	593	10.0	± 8.44	109	6.0	± 5.2	156	5.7	± 3.79	97	4.57	±2.41	..	.....	...	..	.....	...

[1] Differences between component series statistically significant.

[2] Difference between Nigerian and other two series statistically significant; but not between the Dahomean and Ashanti series.

Western Reserve series and the West Africans, the average for this latter series is lower than for the other groups of Negroes measured in the United States, and higher than that of the Jamaican men. No striking differences exist between the West African and American Negro averages in facial width. As might be expected, nostril width is seen to be decidedly larger in the West Africans than in the American Negroes, and this is also true when comparison is made with the average for the Jamaican "Browns". However, the lips of these West Africans are only very slightly larger than those of the American Negroes who reported themselves as being of unmixed African ancestry; while, curiously enough, this West African average is actually lower than that of Davenport and Steggerda's "Blacks", though whether or not this is due to a difference in technique of measurement cannot be stated. The lips of the West Africans are also strikingly thicker than those of any American Negro series represented, though the difference is not as great in the case of the "N" genealogical class of Negroes from the United States as in that of the other groups. The height of the ear in the West Africans is smaller than in any of the New World series, but no outstanding differences for width are apparent.

Perhaps the most significant figures are those having to do with pigmentation, since as far as is known this table presents the only comparisons between West African and American Negroes in this important trait that is based on measurements by observers whose results are comparable.[7] How much darker West African males are than their New World mixed descendants is apparent at a glance, this being especially marked if the difference in the proportion of black on the color top for the Africans and for the "total series" of American Negro males be noted. Comparisons for the other three series also bring up points of interest. Thus, despite Todd's quite acceptable hypothesis that his dissecting room population of Negroes represents individuals having greater amounts of African ancestry than the general American Negro population, the difference between the average of his series and that for the West African males is much greater than a difference due merely to observational error could account for. Even greater are the differences between the Africans, on the one hand, and the Mississippi series and males of the "unmixed Negro" genealogical class on the other.

[7] Cf. Herskovits (1933), pp. 34-38, 69-75; Herskovits, Cameron and Smith (1931), p. 196.

[1] Differences between component series statistically significant.
[2] Difference between Nigerian and other two series statistically significant; but not between the Dahomean and Ashanti series.

The degree to which the skin color of Africans has been darkened by constant exposure to sunlight cannot be estimated, but check measurements taken on the inner side of the upper arm, which is relatively protected from sunburn, show no greater differences than would be expected between the darker outer and lighter inner color of the arm. These figures (for the inner arm) are as follows:

	N	*M*	$\pm\sigma$
N	168	86.65	±2.71
R	168	8.08	±1.59
Y	168	3.64	±1.19
W	168	1.67	± .71

It must also be remembered that the subjects measured in Mississippi "were, in the main, outdoor workers, and both men and women had little protection for their upper outer arms . . . ,"[8] and in this respect are thus directly comparable to the West Africans. Hence while the arms of the "unmixed Negro" genealogical class of the total American series were not sunburned, the difference of almost 13 per cent in the black between them and the West Africans would seem to be too great to attribute it to this cause. If this means that this group, whose members stated that they knew of no mixture, are thus actually of mixed ancestry, then the conclusion must be drawn that the estimate made on the basis of these genealogies, namely, that about 80 per cent of the American Negro population at that time (1912-1926) was of mixed ancestry, must be revised upwards.

The problem of the homogeneity of mixed American Negroes is one that has been shown to be of some importance for the study of the genetics of race-crossing and the problems of human heredity. The comparison of the West African males with the total series of American Negroes bears out the hypothesis that inbreeding among the American Negro group has resulted in an unexpectedly high degree of homogeneity. The most striking differences in homogeneity between the Old and New World Negro groups are where they might be looked for—in nostril width and lip thickness. Yet when comparisons are drawn with the other series represented in Table 4, it is remarkable that in the former trait, Davenport and Steggerda's "Blacks" show a lower mean square variability than does this West African series, (or, if Table 2 be consulted, than two out of the three of its component parts), while

[8] Herskovits, Cameron and Smith (1931), p. 199.

the "Browns" are only slightly more variable. In the case of pigmentation, the variability of the West Africans is much lower than any series of American Negroes observed. Yet this is understandable for, as has been shown, the social selection on the basis of color differences that operates within the American Negro population must have an effect which is exactly the opposite of that resulting in the case of other traits which do not figure in selection and marriage.[9] The resulting heterogeneity of American Negroes, in this trait of skin-color strongly contrasting to the homogeneity of the West Africans, is thus a logical and expected result.

III

1. This study presents physical measurements made in West Africa on Nigerian, Dahomean and Ashanti males during the year 1931.

2. Analyses of the differences between the component series indicate the presence of a type inhabiting the region which, while showing a basic similarity, also manifests local variations in physical form.

3. Traits in which no significant statistical differences exist between the several groups are: height and height sitting, upper and total facial height, width of nostrils and thickness of lips, and physiognomic height and width of ear.

4. Traits that differ significantly are head length and breadth, cephalic index, bizygomatic width, height of nose, and pigmentation.

5. Explanation of differences in head measurements may be referred to social usage, since the Ashanti prefer short to long heads and shape the skulls of their infants, while the Dahomeans do not. The difference in bizygomatic width, which is the opposite of what might be expected on the basis of this cranial manipulation, cannot be explained. The difference in nasal height probably results from inability satisfactorily to locate the naso-frontal suture that constitutes the upper landmark of this measurement.

6. Explanation of the differences in pigmentation, which indicate the development of local types in this regard, must, despite their statistical significance, be held in abeyance until more precise results derived from a more satisfactory technique than the use of the color top are available.

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[9] Herskovits (1926); Barnes (1929), pp. 359-361.

7. Comparison of these series with other West African groups indicate no striking differences, except in the matter of variability between the "true Negro" and the Congo Bantu-speaking type, the latter showing a consistently greater variation in the comparable traits.

8. When the series as a whole is compared with various New World Negro groups, it would seem that the latter represents an even greater degree of mixture than has been realized.

9. Though darker in pigmentation than New World Negroes who know of no racial crossing in their ancestry, it does not seem to follow that this is due to greater degree of sunburn, but is rather an indication of the heavier pigmentation that characterizes the unmixed "true Negro" type.

10. The West African series are more homogeneous than New World Negroes, but the difference in variation is not great and tends to reinforce the hypothesis advanced in the study of American Negroes that inbreeding has resulted in producing a homogeneous type in the United States. In pigmentation, the trait in which American Negroes are most influenced in selection of mates, the variability of the West African series is materially lower than that of their New World descendants, as would be expected because of the mechanics of assortative mating which operate among these latter.

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INSTITUTIONALIZED HOMOSEXUALITY OF THE MOHAVE INDIANS

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THE present body of data has been obtained during three visits to the Mohave Indians, who live at present at Parker, Arizona and Needles, California. Both towns are part of their former habitat.

In view of the fact that equivalent data are largely absent, even from the Yuma who are the next of kin of the Mohave, the present paper will be limited to a discussion of Mohave data.

Mohave sex-life is entirely untrammelled by social restraint and no phase of sex, with the exception of procreation and the introduction to the status of an acknowledged homosexual, has been surrounded with any appreciable amount of observances.

Homosexuality among the Mohave has been reported by the earliest travellers in that region.[1] Although there is little or no objection to homosexuality among the Mohave at present there is no avowed homosexual living on the reservation. This is not surprising in view of the fact that the Mohave at present number less than 500, according to information obtained from the Superintendent of the Colorado River Indian Agency. Nevertheless gossip will have it that certain persons indulge in secret homosexuality. Three men, two of whom are uterine brothers, are at present accused of active and passive homosexuality. One of the two half-brothers is said to be highly intelligent. His adolescence appears to have been somewhat peculiar. At the age of seventeen or eighteen he acted "funny, like a woman." They even accuse him of active sex-relations with a white man, while he was at a certain Indian School outside of the reservation.

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[1] FORDE, C. DARYLL. Ethnography of the Yuma Indians. *University of California Publications in American Archaeology and Ethnology,* Vol. 28, page 96 (quoting the old Spanish traveller FONT), 1931.

His uterine brother lives in the same house with another man suspected of homosexuality. They are usually referred to as each other's wives and are said to indulge in rectal intercourse.

All the above-mentioned men are in their early thirties. None of them however has officially submitted to the transvestite initiation ceremony.

Casual homosexual relations in early childhood were frequent in the past and, according to my informants, seem to be on the increase at the present time. "Nowadays the kids at school don't get a chance to play with the opposite sex and therefore they go off into the bushes and copulate with other boys or other girls." But even in the past mutual masturbation, urinating competitions, measurements of phalli, etc., have been quite frequent. Complete nudity and lack of any kind of supervision, especially of boys, who remained naked until they reached puberty, combined with incessant sexual talk on the part of adults, must have furthered the desire for sex-experience. Water-games were especially favorable for sexual intimacy, which, however, seldom if ever led to actual sex-relations in the water because the Mohave believe that intercourse in the water causes a certain disease in women.

Children banded off in mixed groups composed of boys as well as girls. They exhibited their genitalia, poked fun at each other's conformation and referred to each other by sobriquets derived from the size or conformation of their respective genitalia, such as "sharp, crooked, blunt or stubby penis". Not seldom older boys got hold of one of their comrades, pulled back his foreskin and smeared mud on the exposed gland. Mutual masturbation was not absent but rather uncommon. Older boys, however, often performed forced rectal intercourse on their younger playmates. Fellatio was rare, but not entirely absent.

Masturbating and urinating competitions were frequent. In masturbating competitions both the shortness of the time required to cause ejaculation and the distance at which the sperma was projected was taken into consideration. Urinating competitions consisted of urinating figures and letters on the ground.

Adults seldom had sexual intercourse with children of their own sex, although betrothal of young girls to old men or seduction of very young boys by adult women was not rare.

A Walapai Indian of about twenty-five years of age went to hunt with a twelve year old Walapai boy. He was an inveterate homosexual and had intercourse with the boy in a wash. When they returned to the settlement the boy had such pains in his rectum that he could not sit down. His parents menaced him with a whipping if he did not sit down. They also refused to give him food until then, thinking he was being naughty. At last the boy broke down and confessed the events of the hunting expedition. The parents prosecuted the offender, who ran away into the Mohave territory, because the Walapai speak a similar language and are really of our own kind. They held a trial at Kingman. The Mohave policeman from Parker went to arrest the man. He found him at Topock and brought him back handcuffed. He was sent to prison.

No similar Mohave case has been reported, and the Walapai Indian's actions were severely condemned.

Homosexual activities of children were not considered to be truly homosexual, but dismissed as mere infantile naughtiness. Nor was the man in the case-history about to be reported considered a homosexual.

Kwiskwinay had been sentenced to a term in prison, for burying alive the newborn child of his sister, partly because that was the customary way of killing half-breeds, and partly because his sister's Mexican husband deserted her and denied the paternity of the child. In prison Kwiskwinay had anal intercourse with a white prisoner. "First the white man 'bent over', then I did", he has been reported as saying. Upon his release he often complained of diarrhoea, explaining that the great phallus of the white man hurt him. A niece of Kwiskwinay describes him as a "kind man, but d- - -n impulsive". (It may be noted here that according to information obtained from the Mohave, as well as from the late Anna Israel-Nettle M. D., the genitalia of the Mohave male are small in size when compared to the genitalia of the average Caucasian or to the size of the vagina of Mohave women.)

Another example of what is not considered homosexuality by the Mohave will be drawn from the early life-history of future shamans. Such boys are very unruly and not seldom "pull back their penis between their legs and then display themselves to women, saying 'I too am a woman, I am just like you are' ".

TYPES OF HOMOSEXUALS

The Mohave recognize only two definite types of homosexuals. Male transvestites, taking the rôle of the woman in sexual intercourse, are known as alyha·. Female homosexuals, assuming the rôle of the male, are known as hwame·.[2] Their partners are not considered homosexuals,

[2] KROEBER, A. L. Handbook of the Indians of California. *Bureau of American Ethnology,* Bulletin No. 78, p. 748, 1925.

and from the evidence of our case-histories appear to have been invariably persons of bisexual tendencies, who did not go through any formal initiation and were not designated by any special name.

While there exists no mention of any transvestite Mohave culture-hero comparable to the culture-hero of the kindred Kamia,[3] homosexuality and the initiation-ceremonies thereto pertaining are mentioned in the creation-myth—the only other section dealing with things sexual being concerned with procreation and the intimately related puberty ceremonies.

The following account was obtained from the late Ñahwera, an almost senile singer, said to be the last person to know the transvestite initiation songs. It has been further expanded by several other informants. Neither the above-mentioned singer nor the informants in question were homosexuals.

"From the very beginning of the world it was meant that there should be homosexuals, just as it was instituted that there should be shamans. They were intended for that purpose. While their mothers are pregnant, they will have the usual dreams forecasting the anatomic sex of their child. Thus the mothers of alyha· dream of arrow-feathers and other male appurtenances, while the mothers of hwame· dream of feminine regalia such as beads, etc." (This is curious in view of the fact that beginning with the sixth (lunar) month of elapsed pregnancy the foeti are said to be conscious and dream of their future destinies, sharing to a certain extent their dreams with their mothers, and vice versa.) "At the same time the dreams of their mothers will also contain certain hints of the future homosexual proclivities of the child about to be born." (No data as to the nature of these "hints" could be obtained.) "For several years following birth these homosexual tendencies will remain hidden. They will come to the fore, however, previous to puberty: that is, the time when young persons become initiated into the functions of their sex, such as hunting or cooking, respectively. None but young people will become berdaches as a rule. Their tendencies will become apparent early enough to cause them to be tattooed in accordance with the tattooing pattern pertaining to their adopted sex. Once a young person started off 'right' there is no danger of his or her becoming homosexual (alyha· or hwame·) even if occasional unions with homosexuals should occur. They will feel toward their possible transvestite mate as they would feel toward a true woman, respectively man."

This point is crucial. The transvestite must attempt to duplicate the behavior-pattern of his adopted sex and make "normal" individuals

[3] GIFFORD, E. W. The Kamia of Imperial Valley. *Bureau of American Ethnology*, Bulletin No. 97, p. 12, 1931.

of his anatomic sex feel toward him as though he truly belonged to his adopted sex. Forde[4] describes this situation very accurately. "When he (i.e. the transvestite) came out of the dream, he put his hand to his mouth and laughed four times. He laughed with a woman's voice and his mind was changed from male into female. Other young people noticed this and began to feel toward him as to a woman."

Any person who dreamt about becoming a transvestite while in the maternal womb may turn into one. They then attend to the occupation-pattern of their adopted sex, except that female transvestites may not be tribal or war-leaders. Social status however seemed to play a certain rôle. One female informant, herself a member of a chiefly family, stated that only persons classified as ipa tahana (person really, i.e. member of a prominent family) became transvestites, as a rule. Conversely it was said that only "normal" persons possessing special powers, especially shamans specializing in the cure of venereal diseases and credited with special luck in love, may secure transvestite spouses.

OTHER DETERMINANTS OF HOMOSEXUALITY

Beyond the factor of predestination, other factors also influenced the decision of certain persons to become transvestites.

"The chief may hold gatherings and people became transvestites through his (spiritual) power." This statement has never been explained. "In recent times a certain youth at Needles became a homosexual through listening to the alyha songs of Ñahwera, who sang his songs at feasts and funerals." (Any song may be sung on those occasions.) "That youth was a relative of my husband. Eventually he got sores about his rectum and died. Now Ñahwera does not like to sing his songs any more."

"A boy may begin to act strangely just as he is about to reach puberty. At that time other boys try to act like grown-ups and imitate their elders. They handle bows and arrows, ride horses and hunt, and make love to little girls. These boys, however, will shun such tasks. They pick up dolls and toy with metates just as girls do. They refuse to play with the toys of their own sex. Nor will they wear a breech-clout. They ask for skirts instead. They will watch a woman's gambling game which we call the Utah-game—as though they were under a spell. This game will fascinate them. They will try to participate in this game whenever they see it." (This game consists in throwing four dice, one of which is called "male" because it is painted black, and another "female", because it is painted red. The fall of these dice is accompanied by much obscene comment. When the red die falls on top of the black one comments like "this woman is actively copulating with her mate" are made.)

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[4] FORDE, C. DARYLL. *Op. cit.*, p. 157.

"Girls will act just the opposite. They like to chum with boys and adopt boys' ways. They throw away their dolls and metates, and refuse to shred bark or perform other feminine tasks. They turn away from the skirt and long for the breech-clout."

"Their parents will eventually notice this strange behavior and comment upon it. 'Well, he may be a boy, but he seems to be more interested in the ways of women'. Corresponding comments are made about boyish girls. Parents and relatives will sometimes try to bully them into normal behavior—especially the girls, but they soon realize that nothing can be done about it. 'If our child wishes to go that way, the only thing we can do is make it adopt the status of a transvestite.' They are not proud of having a transvestite in the family, because transvestites are considered somewhat crazy."

After the above information had been obtained a trip was taken to Needles by the present writer, his interpreter and his chief informant, to obtain the four alyha· songs from Ñahwera. The following is his account. The songs themselves are in a very old-fashioned Mohave, almost unintelligible to the younger generation and consisting of mere catchwords, in accordance with the customary Mohave style of singing.

Ever since the world began at the magic mountain Avi-kwame· it was said that there would be transvestites. In the beginning, if they were to become transvestites, the process started during their intra-uterine life. When they grew up they were given toys according to their sex. They did not like these toys however. At the beginning, the God Matavilye died at Avi-kwame·, not because he had to die, but because he wanted to set mankind an example. There is the house. He is on his death-bed and people are all around him. He tells them that their lives would be different, and some among them would turn into transvestites. Then Matavilye died. All the people went their own way but Matavilye loved mankind so much that, although he was already on his way to heaven, he returned to be cremated in our fashion. Had he not returned to us, we would have been just like the Whites: evil, cruel and grasping. He cared for us so much that he returned to be cremated on earth. If a ghost comes to visit the earth he does it because he likes the earth very much. If from underneath the cremation pit a whirlwind rises, it means a soul went in there, because it thought so much of the earth. Then all things begin in that death-house. When there is a desire in a child's heart to become a transvestite that child will act different. It will let people become aware of that desire. They may insist on giving the child the toys and garments of its true sex, but the child will throw them away and do this every time there is a big gathering. Then people prepare a skirt of shredded bark for the boy or a breech-clout for the girl. If they give them the garments worn by other members of their sex they will turn away from them. They do all they can to dissuade girls who show such inclinations. But if they fail to convince her they will realize that it cannot be helped. She will be chumming with men and be one of them. Then all those who have tried to change her conduct will gather and agree that they had done all that could be done and that the only thing for them to do was to give her the status of a transvestite.

These female transvestites (hwame·) are like lewd women who also throw away their house-keeping implements, and run wild. These songs are called alyha· kwayum or alyha· kupama and are for boys. The singer refers to himself as Pameas and describes their actions in these songs.

These are the four songs.

(1) Akueña / ahvayatco / kwetokoñe / kanava / avera / tovara / ku-añaye / huyaytatkohav / touama / iðauav / vovaa / iðaui / kanava / avakwiðaui / avavono / kaviya / epatcomitcam / tcoom / kwaava / eekanava / veevaua /

(1′) To twist / make dress / front part / tell of it / finished / wants it / light (bright) / take up the skirt and tie it in front / around / take / (describing immediate action) / take / tell of it / all listening / now all hear / then / people gathered there / all / hear / tell of it / standing.

(1″) This song describes how to put on a skirt and tie the string around the waist and how not to tie it on the side. Now all are here to see and hear and if you cannot help acting that way, then act that way, so that all may see what you are.

(Interpreter comments: "This transvestite fellow is now as happy as a bug, because he got a skirt.")

(2) Pamekwa / ñiha / lakuye / ñivatce / iðoma / ñivatce / nalye / ava / hiðaua / mataramkutcatc / hatciñe / kopama / kwi-yahve / tcinvakwa / ava / hevatce / nalya / .

(2′) People / by being looked at / proud / traipse or waddle / turning to / that side / they / all hear / a flat stretch of ground which is still damp / unmenstruated girl / dancing back and forth / dances stooping / even if girl (unmenstruated) / feels / she dances / that side / .

(2″) This describes the hwame· (?) who, proud of being stared at, traipses and dances back and forth in a stooped posture over a flat stretch of damp land. That is how she acts if she is to be a true hwame· (?).

(3) ñikatño / memkwiya / ñikatcivas / viya / ñikatco / ðoraviya / ivamavi / ivaua / iðaua voova / iðaua / ñikatcolok / isto / ivatce / nalya / ðauave / veðeye / kaanava / toomtcoya-toomtcoðome / amayamtcuya / kaanava / hatciñma / kopama / itcavono / ihatim / añoorá / ñorávo-vonova / ñoravova / hatciñekwo / ava / hañorám / vono / kawimaava /

(3′) Advances / stalking / advances / furtively / advances / sneakingly / reaches / there / stands and takes it / takes it / furtively cuts in pieces / gathers / backing / away / takes it / comes back / tells of it. / Divides them (dice) / tosses up / tells of it / girl / stoops (dances) / gathers / will split / paints / in the act of painting / ready to paint / girl (unmenstruated) / hear / in the act of painting / can't make "her" (male transvestite is meant) do otherwise / .

(3″) (This song refers to the attraction of the split-stick dice-game for the future male transvestite.) "He advances stealthily toward the willow, he stands there and cuts the branches and gathers them up. He tells about it. He divides them up, he tosses them up and tells the girls about it. He stoops, gathers the pieces, splits them, paints them and the girls hear of it. He cannot do otherwise".

(Interpreter's comment: "If he were a man he would be painting arrows, not dice.")

(4) Hatom / askilye askilyem / kaanavam / kunovum / awi / askilaskil / vonokowi /

(4′) Spit / marks / zig-zags / tells of it / tells of it / ? / marks / doing it.

(4″) This song describes the patterns painted on the dice.

The nature of the present songs is perhaps doubtful. They were said to describe the ceremony of initiation, and indeed the songs quoted by Kroeber[5] are somewhat different, However Kroeber also mentions songs to which the transvestite dances. Whether these are the songs in question is open to debate. The remark "anyone is free to learn these songs and the ceremony" leads the present writer to believe that these songs are sung during the initiation. The question is one on which he would not care to dogmatize. Ñahwera was senile and toothless. The presence of the main informant was necessary, because he had heard the songs before and could pronounce the words clearly after hearing them. However, the fact that the latter was a shaman and believed to be a witch so excited Ñahwera that ever since he avoided the three of us to the great amusement of the reservation.

The ceremony in question appears to have been a sanctioning of the inevitable, which is typical of almost any human society.

The scene at the initiation is vividly described in these songs. The future transvestite is the centre of interest. Just what rôle the chance of "showing off" at any price may play in the psychology of a child entering upon this momentous decision, need not be discussed here.

CEREMONY OF INITIATION

We possess three accounts of the ceremony in question. The general patterns of all accounts are similar, but the differences are by no means negligible. It is suggested tentatively that Mohave ritualism is extremely

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[5] KROEBER, A. L. *Op cit.*, p. 748.

loose, and that in the case of a comparatively rarely performed semi-private ceremony considerable variations were likely to occur. Furthermore the time element must be taken into consideration. The ceremony in question has not been performed for several decades. It has been thought best to quote all available versions.

The following account has been published by Kroeber.[6]

Four men who have dreamed about the ceremony are sent for, and spend the night in the house, twisting cords and gathering shredded bark for the skirt the prospective *alyha* will thereafter wear. The youth himself lies, with two women sitting by him. As they twist the cords, the men sing:

ihatnya vudhi.....roll it this way.
ihatnya va'ama.....roll it that way.

When the petticoat nears completion:

istum.....I hold it.
icham..... I place it.
hilyuvik..... it is done.
havirk.....it is finished.
ka'avek.....hear!
kidhauk.....listen!

These songs the singers dreamed when they were with the god Mastamho, and during the night they tell and sing of how they saw him ordering the first performance of this ceremony.

In the morning the two women lift the youth and take him outdoors. One of the singers puts on the skirt and dances to the river in four steps, the youth following and imitating. Then all bathe. Thereupon the two women give the youth the front and back pieces of his new dress and paint his face white. After four days he is painted again and then is an *alyha*. Such persons speak, laugh, smile, sit, and act like women. They are lucky at gambling, say the Mohave, but die young. It is significant that a variety of venereal sickness which they treat is also called *alyha*.

Sometimes, but more rarely, a girl took on man's estate, among both Yuma and Mohave, and was then known as *hwami*, and might marry women. There was no ceremony to mark her new status.

The next two accounts were obtained by the present writer.

The first was obtained from an old woman of about eighty, who was not herself a hwame·. She stated that she had heard of this ceremony from a woman who in her youth used to be on friendly terms with an alyha·. "She always thought that this alyha· was really a woman, until the transvestite lifted something one day and as the fibers of the bark-

[6] KROEBER, A. L. *Op. cit.*, pp. 748-749.

skirt parted his penis became visible. My friend was aghast when she noticed that her *girl-friend* had a penis and testes. This transvestite told her about the ceremony, and she told me about it." (It is to be suspected that the "astonishment" was a mere flower of speech, in view of the fact that sex and transvestites are regularly discussed.)

"The ceremony was held on a flat stretch of land. The crowd foregathered on both sides of the terrain. On one side were the women with the skirt and on the other the boy with the singer. The singer sang and the boy danced. When this part of the ceremony was over, the singer explained to the boy every part of the feminine wearing apparel. Since not all women know how to make a dress, the singer had chosen beforehand some capable woman to make the initiate's dress. The alyha· was then taken to the river where he bathed. He kept his old name. He did not assume the gentile name which is borne by the females in every lineage. I don't know whether or not they held ceremonies for the hwame·. I knew a hwame· once. She was dressed like a woman but she was married to other women. I have never seen the ceremony myself. They don't hold it any more."

This informant also stated that the hwame· did not change their name for a name of the male type, which is obviously a mistake, as is apparent from the name of the hwame· Sahaykwisa (contraction of masahay: childless girl or woman; and matwisa··: soul or shadow, i.e. girl's shadow, which is a typically male name.)

It is true however that no male transvestite adopted a gentile name. Tampering with gentile affiliations and with the quasi-sanctity of the perpetuation of the lineages and of the tribe, by dragging it into the humoristically viewed homosexual cluster, would have been repulsive to the Mohave.

In ancient times the hwame· wore male garments.

The next account was obtained from a "normal" male shaman, an unusually well informed and willing informant. He derived most of his knowledge on this subject from a long friendship with the late Kuwal, who had married several alyha·. Kuwal's history will be reported at the end of the present paper.

"The boys who became alyha· were initiated fairly early. They did not have their noses pierced, because they did not go through the male puberty ritual." (This would place the tranvestite initiation as early as the tenth or eleventh year of age.) A subsidiary informant also claimed that if a man was found to have submitted to rectal intercourse he was

compelled to undergo the initiation, but this statement has been unanimously discredited. (Curiously enough, it was said that some women became hwame· after having borne a child.)

"When the child was about ten years old his relatives would begin discussing his strange ways. Some of them disliked it, but the more intelligent began envisaging an initiation ceremony. They prepared in secret the female wearing apparel. There was no singing, lest the boy should discover what was going on. Then they asked a singer to perform the ceremony on a certain day. They did not want the boy to know of it ahead of time. The ceremony was meant to take him by surprise. It was considered both an initiation and an ultimate test of his true inclinations. If he submitted to it he was considered a genuine homosexual. Word was sent to various settlements, inviting people to attend the ceremony. They wanted them to see it and become accustomed to seeing the boy in a woman's dress." (Such "accustoming" feasts were also held when someone lost an eye.) "The time and place were set by mutual accord of the boy's family and relatives. There was no feasting, only a gathering which was held early in the morning. If the boy acted in the expected fashion during the ceremony he was considered an initiated homosexual, if not, the gathering scattered, much to the relief of the boy's family."

"The singer drew a circle in the centre of the track with a pointed stick. The boy was led by two women, usually his mother and maternal grandmother, since women have more to do with children than the males, into the centre of the circle. If the boy showed willingness to remain standing in the circle, exposed to the public eye, it was almost certain that he would go through with the ceremony. The singer, hidden behind the crowd, began singing the songs. As soon as the sound reached the boy he began to dance as women do. Gradually the singer approached the dancer. The dance-steps do not change, except insofar as the boy plays a pantomime in accordance with the text of the songs. Were the boy unwilling to become a homosexual officially, he would refuse to dance. As it is, the song goes right to his heart and he will dance with much intensity. He cannot help it. After the fourth song he is proclaimed a homosexual. The same women who led him into the circle, accompanied by other women, take him down to the Colorado River. After a bath he receives his skirt. He is then led back to the dance-ground, dressed as a woman and the crowd scatters. The same ceremony is enacted for the hwame· who then dons the breech-clout."

As may be seen from the three versions presented they are complementary rather than divergent, except for minor details.

The effects of the ceremony were permanent. Just how far the chance of making a display of himself in front of a crowd of adults may have swayed a boy with some bisexual tendencies, is not easy to decide.

The initiated transvestites then assumed a name befitting a person of the opposite sex. They resented afterwards being called by their former names. The Mohave change their names fairly often and resent being called by their discarded names. "They get tired of their old names." A curious feature of Mohave name-giving may be mentioned here. Persons often assume names which are a slur on or a reference to the opposite sex, or an uncomplimentary remark upon certain habits of other persons. A certain man is known by the name of hiθpan utce· (vagina charcoal) and a woman called herself hama utce· (testicle charcoal) in retaliation.

It is emphatically stated by the Mohave that the ceremony did not operate the change in the initiate's personal habits. It was merely a test and a public acknowledgment of the shift from one sex to the other. I pointed out elsewhere that the Mohave believe that at creation and during the early periods of the mythical era there existed sexually undifferentiated stages. Thus it was not too great an effort for them to believe in the reality of such a shift.

Nowadays homosexuals do not don the garb of the opposite sex. The woman responsible for the first version of the above ceremony made the following statement.

"Years ago I knew a man who was very effeminate. He did not go through the ceremony, because it was no longer held. He always sat down the way women do and disposed his breech-clout the way women do when they sit in the Turkish posture, or with one leg folded (or tucked) under them. He probably thought he was concealing his vulva. One of my relatives was a hwame·. She had small breasts and wore a breech-clout." (She had stated that no hwame· wore a breech-clout. Cf. above.)

Since the hwame· rode and hunted, she had to wear the male garb. Sahaykwisa however wore a skirt and shoes, because occasionally she was prostituted to white men. She had big breasts, but never bore a child. One informant stated that alyha· "had red stripes painted across their bellies", red being the women's paint par excellence. Sahaykwisa occasionally painted herself black, like a warrior on the warpath.

No mention is made of any physiological deformity in homosexuals. The "small breasts" referred to above were bigger than those of an im-

mature girl, and were probably termed small in comparison with the big pendulous breasts of the average Mohave woman. The woman informant and others stated that the hwame· menstruated only sporadically, but were not certain about it. No hwame· ever bore a child after assuming that status. The same woman informant stated that the alyha· had no erection, which is disproved by the case history of Kuwal. There is no mention of an abnormal clitoris. The most careful and repeated inquiry over a period of several years did not elicit any suggestion of anal masturbation in the case of alyha·. Both vaginal and clitoridal masturbation was practiced by both normal and homosexual women. It was stated that the alyha· had erections during anal intercourse, whenever it was performed upon them, but resented it if their partners touched their erect penes, although letting them manipulate them in the flaccid state. Whether all alyha· had emissions of sperma during anal intercourse performed on them has never been ascertained.

PHYSIOLOGICAL PATTERN ASSUMED BY HOMOSEXUALS

One of the most peculiar aspects of institutionalized homosexuality is the imitation of the physiological pattern of the assumed sex by homosexuals. They resented any normal nomenclature applied to their genitalia. Alyha· insisted that their penis (moδar) be called a clitoris (havalik), their testes (hama·), labia maiora (havakwit), and their anus (hivey), vagina (hiθpan). The hwame· equally resented any reference to the fact that they had vulvae, but it was not stated that they insisted on a corresponding male terminology. It is interesting to note that according to anatomic and embryologic observations the penis and clitoris, the rectum and the vagina, the scrotum and the labia are histologically of the same origin, the rectum and the vagina being formed from the hind gut of the embryo.

Since homosexuals resented such references, they were often teased in that fashion. "Just as a man would not like to be told he had a cunnus or a woman that she had a penis, so an alyha· resented references to his penis, and a hwame· remarks upon her vagina." (A certain Mohave man, upon being asked by his wife to bring her some water, exclaimed: "Perhaps I have a cunnus and should don your skirt too. Give me your skirt and you can have my breech-clout and go hunting.") "You can tease an hwame·, because she is just a woman, but if you tease an alyha·, who has the strength of a man, he will run after you and beat you up. He will assault you many days later, if he could not catch you

at once." "A certain man passing by the house of an alyha· said to him in jest, 'How is your penis today?' 'Not penis, cunnus', replied the alyha· angrily. 'Well then, how big is your cunnus?' the man replied, using the word "erection" instead of "big". The alyha· picked up a club and for one or two weeks tried to assault the man whenever he saw him."

Intercourse with an alyha· is surrounded by an etiquette all of its own, to which the partner had better conform "lest one should get into all sorts of trouble."

"This is what Kuwal, who had several alyha· wives, told me," the shaman said. "Kuwal had rectal and oral intercourse with his alyha· wives, but if you copulate too often rectally with an alyha· he will get hemorrhoids, just as our women do when we have too much anal intercourse with them. You may play with the penis of your *wife* when it is flaccid. I often did it, saying, 'Your cunnus is so nice and big and your pubic hair is nice and soft to touch'. Then my alyha· wife would loll about, giggling happily like this, 'hhh'. *She* was very much pleased with herself and me. *She* liked to be told about her cunnus. When alyha· get an erection, it embarrasses them, because the penis sticks out between the loose fibers of the bark-skirt. They used to have erections when we had intercourse. Then I would put my arm about them and play with the erect penis, even though they hated it. I was careful not to laugh aloud, but I chuckled inwardly. At the pitch of intercourse the alyha· ejaculate."

"Kuwal used to tell about these things in public. When we asked him why he did not tell his alyha· wife that *she* had an erection, he used to say, 'I would not dare do it. *She* would kill me. I never dared touch the penis in erection, except during intercourse. You'd court death if you did it otherwise, because they would get violent if you play with their erect penis too much'."

It is noteworthy that in English all Mohave refer to an alyha· as *she* and to a hwame· as *he*. This becomes quite confusing to the field-worker, at times, but also proves the highly institutionalized character of this cultural complex.

When an alyha· found a husband, he would begin to imitate menstruation. He took a stick and scratched himself between the legs until blood was drawn. This he referred to as "catamenial flow" and submitted to the whole set of puberty observances, then as well as during subsequent "menstruations". According to the Mohave pattern, when

a man marries an unmenstruated girl he has to share a great deal of her puberty taboos when she menstruates for the first time. Since the alyha· claimed this to be his first menstruation, the husband had to submit *nolens volens* to the whole set of observances.

Even more curious are the pretensions of alyha· concerning their hypothetical pregnancies. When they decided to become "pregnant" they ceased faking menstruations. They observed the customary pregnancy taboos as rigidly or even more so than normal women, conforming to many obsolescent customs even, and compelling their husbands to observe their share of taboos, as befits expectant fathers. They publicly boasted of their pregnancy, even though many Mohave women deny being pregnant, even when it has become obvious to all and sundry that they were pregnant. This gave rise to never ending jests, but the alyha· paid no attention to them. In only one way did they fail to conform to the usual pregnancy pattern. Having no other means at their disposal, they continued oral and rectal intercourse with their husbands, even though the former is alleged to harm the foetus' glottis and the latter his bowels. In the absence of their husbands they stuffed rags and bark under their skirts, in increasing quantities, to make their abdomen protrude. In due time they made a decoction of mesquite beans which is said to cause sever constipation. They drank this decoction by sucking it through their teeth, which acted as a sieve and prevented the swallowing of bean-fragments.

Eventually they had severe abdominal pains for a day or two, which they dubbed labour-pains. When the faeces could not longer be withheld the alyha· went into the bushes and defecated sitting over a hole in the traditional posture of parturating women. They had no assistants, and leaned therefore against a tree, as did women who were in travail before any feminine help could be obtained. The faeces were said to be thick, dry and friable and caused a bleeding of the rectum. They then pretended that stillbirth had taken place and buried the faeces and a little log. After that they returned to the house and claimed to have given birth to a stillborn child. They had to pretend it was a stillbirth, because stillborn babies are buried whereas those dying are cremated publicly, and "such ceremonies are past joking". Yet people would hear the alyha· wailing and mourning for the imaginary child. They clipped their hair and compelled their husbands to clip their hair in the fashion befitting the mourners. Since the Mohave never made any preparations

for birth, because boys and girls had to have different cradles, no problem arose from the disposal of empty cradles.

"People used to tease me about my wives' imaginary children," Kuwal is reported as saying. "When I walked about with friends and spoke with regret of the real children I had once and of my beautiful Cocopa and Yuma wives who were real women, they used to say, 'We know all about your beautiful wives. You married those alyha· and believed them when they scratched themselves and pretended to be menstruating, or when they were pregnant with a pillow.' Or else they would kick a pile of animal dung and say, 'Those are your children'. And yet I had real children once and they died. Were they not dead they would now take care of me in my old age."

COURTSHIP

Alyha· were not courted like ordinary girls. The man did not go to the alyha·'s house or to the house of his parents, and sleep beside him in chastity for a night or two, before leading him away to his home. They were courted at gatherings like widows, divorcées or lewd women (kamaloy). Either the man or the alyha· may initiate the flirtation. It is not impossible however that for the sake of creating a comical situation, a thing paramount in the Mohave pursuit of sexual pleasure, on occasion a man went through the habitual courtship for an alyha·, because it appealed to his sense of the preposterous. Casual meetings also led to such unions. "A man went to swim. In the water an alyha· seized his penis. 'What do you want,' the man asked briskly. He was so angry that later on he went to the house of the alyha· and asked him how his penis was that day." (Cf. above for the rest of the incident.)

At dances even boys who had no intention of marrying an alyha· played around with them, as though they were flirtatious women. "In the end some of them made up their minds to become the husbands of an alyha·".

Once they were married the alyha· made exceptionally industrious wives. At every step the Mohave emphasize the lure of feminine occupations for future alyha·, a point which has hitherto been neglected in the study of precipitating causes in homosexuality. We shall come back to this point later. At any rate the certitude of a well-kept home may have induced many a Mohave to set up house with an alyha·. Having a well-kept house is not an easy problem among the Mohave who have young wives. "Girls cannot be counted upon to settle down",

a woman said. The desire for good food and a well-kept household induced many Mohave to marry older women, even their former mothers-in-law, because old women were anxious to work hard to please their young husbands and make up by good food for their aged charms.

Divorcing an alyha· was not an easy matter. "They are so strong that they might beat you up", Kuwal used to say. "Some men who had enough of it tried to get rid of them politely, alleging barrenness of the alyha·. But no alyha· would admit such a thing. They would begin to fake pregnancy."

It may be said that the Mohave indulge in so much anal intercourse with women, that being the proper way to prepare immature girls for marriage, and even later on "even though the rectum of a woman is just like a man's rectum", and also indulge in so much fellatio, that they were able to obtain as much pleasure with an alyha· wife as with a woman. (hivey añie·nm, anus intercourse; ya tcahaetk, fellatio).

That, combined with the incessant search for new thrills in travel, war, love and humour, induced Mohave men to set up housekeeping with alyha· wives.

However, since the husband of the alyha· had to bear the brunt of the jokes that flew right and left in his presence, such unions were not stable, even when compared to the very unstable normal marriages. They seldom teased the alyha· himself. "He was an alyha·, he could not help it." But the husband of an alyha· had no such excuse and was fair game to all and sundry.

Returning to the hwame· they had no possibility of duplicating the male physiological pattern except in a single instance. The Mohave believe that by intercourse with an already pregnant woman the paternity of the child changes. Whenever a hwame· succeeded in getting a pregnant woman, she claimed the paternity of the child and took care of it with pride and loved it very sincerely. However the tribe did not recognize the change in gentile affiliation in that case, as it did in the case when a pregnant woman left her husband for another man. As we said before, gentile continuity is past joking.[7]

Intercourse between the hwame· and her wife was varied in scope, ranging from digital immission and fake intercourse with the wife in supine posture and the hwame· on top, to a special posture referred to as

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[7] DEVEREUX, GEORG. Der Begriff der Vaterschaft bei den Mohave Indianern. *Zeitschrift für Ethnologie,* in press, 1937. Contains a discussion of fictitious and plural paternities where promiscuous women are involved.

hiθpan kuδape (vaginae split). The wife was stretched out in the supine posture. The hwame· lies with her head in the opposite direction, one of her legs under the wife's body, the other on top of it. In this posture of interlocking scissors the vulvae touched. Sometimes the posture was modified and the torsoes brought close together. No cunnilinctus (hiθpan ata·uk) was ever practiced among the Mohave, although they know that it occurs among the Whites. This absence is due to the horror of the vaginal odor. Kuwal often got into trouble by exclaiming, "Phew, you women smell like fish".

The hwame· got their wives usually at dances or by visiting girls and married women during the day. They never dared to try the ordinary courtship, because of the girl's parents.

The hwame· were excellent providers and took pride in dressing up their wives. Sahaykwisa who was a shaman earned good money and went to the length of prostituting herself to Whites to be able to keep her wives in comfort. Living with an industrious hwame· may have held some lure for a woman who had some experience with flighty, lazy and spendthrift husbands. "In their free time the hwame· would attend gatherings, and speak of the genitalia of their wives and mistresses as do salacious men. But then, no one ever expected a hwame· to behave herself. She would sit among the men and describe the vulva and the pubic hair of her wife."

Naturally the hwame· did not observe their own menses, but submitted to the taboos of the husband of a menstruating or pregnant wife.

Hwame· were divorced by their wives more often than they divorced them. Divorce consists simply of leaving the spouse. Their wives were usually teased until they could not bear it any longer, and naturally a hwame· was not physically in a position to fight with strong men. However Sahaykwisa once made the pretence of going on the warpath against the abductor of her wife, and since she was at the same time a shaman capable of witchcraft, she was comparatively safer than most other hwame· who were not feared.

No alyha· is reported ever having had intercourse with a woman. Some women however turned hwame· after they had a child. It was hinted that painful childbirth may not have been foreign to this decision. Occasionally a hwame· was raped or even prostituted, as was the case with Sahaykwisa.

PSYCHOLOGICAL PATTERNS

Transvestites were said to be lucky at gambling, and the Mohave did not share the belief of some other Yuman tribes that they died young. Transvestites were exceptionally powerful shamans, especially the hwame·. Kroeber's statement that the alyha· cured the venereal disease known as alyha· could not be substantiated by the present writer. It would be impossible in the present article to go into the psychological reasons of this alleged superiority of power, except for two hints. Shamanism is linked with weird things and odd behavior, including prenatal phantasies and homicidal and suicidal impulses, the latter caused by longing for permanent reunion with the ghosts of the beloved victims of their witchcraft, with whom they have intercourse in dream. This situation has been roughly outlined in an article of the present writer on Mohave Soul Concepts.[8] The other hint refers to the intra-uterine and birth-phantasies of shamans, described by Roheim[9] and Kroeber[10] and not unlike similar phantasies of schizophrenics, according to verbal confirmation of the present writer's impressions by Dr. Bettina Warburg.

Conversely, shamans specializing in the cure of hikupk (syphilis), were lucky in love and had no difficulty in obtaining homosexual spouses. Kuwal was a hikupk shaman.

Homosexuals, according to the belief that witches always bewitch persons they are fond of sexually and otherwise, mainly bewitched persons of their own anatomic sex, and dreamed of intercourse with the ghosts of their victims. This was not harmful as would be the case if they were not shamans, in which case they would be afflicted with the dread ghost-weylak disease. For a normal person to dream of homosexual relations also causes weylak, which is usually fatal. Our woman informant's daughter, aged about 40, died of this disease shortly after she reported the following dream to the present writer: "I dreamt women wanted to have intercourse with me. They were close relatives or friends. I knew they were women, but they acted like men. They pulled my skirt up, threw me and tried to get on top of me. I fought them off and intercourse was never performed on me. I expect to get very sick,

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[8] DEVEREUX, GEORGE. Mohave soul concepts. *American Anthropologist*, n.s., Vol. 39, 1937.

[9] ROHEIM, GEZA. Psycho-Analysis of primitive cultural types. *The International Journal of Psycho-Analysis*, Vol. 13, pts. I-II, pp. 187-188, 193-194, 1932.

[10] KROEBER, A. L. *Op. cit.*, p. 754. Cf. also KROEBER, A. L. Earth-Tongue, a Mohave. In "American Indian Life". E. C. Parsons, Ed. Pp. 190, 201, 1925.

because the fact that they were relatives makes the dream doubly bad." (Men never allow women to get on top of them, which happens only when women abuse a dead-drunk man.)

Turning to the status of homosexuals, we shall find that it is of a somewhat complex nature. They were, so far as the alyha· are concerned, rather peaceful persons, except when taunted. Interpreter stated, "My husband is far too kind. I always tell him that he is so stupidly kind that if anyone wished to have rectal intercourse with him, he would go down on all four and spread his buttocks." (The man in question is not a homosexual, but a person of an exceptionally kind and sunny disposition, even for a Mohave, which is a great deal to say.)

The alyha· were said to be cowards. The word "malyhaek" (thou art a coward) clearly shows this belief. It may not be beside the point to recall in this connection the lure feminine pursuits are said to possess for the alyha· and the fact that the Mohave were exceptionally warlike and adventuresome and prized bravery above many other virtues, and next to power obtained in dream. Except when retaliating for a raid they used to declare war upon their enemies—a procedure unknown among most aboriginals—and stood their ground to the last man against overwhelming forces. War was sport and the use of horses or guns was considered despicable. The last abortive raid of a few Mohave and Yuma against the united Maricopa and Pima, most of the latter armed with guns and on horseback, is strictly comparable to the last stand of the three hundred Spartans. Cowards were despised, and all men expected to participate in raids. Such demands were not made upon alyha·. I do not suggest that this might have had something to do with the decision of some faint-hearted boy who became an alyha·, but the possibility may be given consideration. As alyha· they could take the position of women at the yakkiδaalyk, or welcome feast for warriors returning from a raid. At that feast old women, who have lost a relative in the battle, would taunt those who did not go to war in the following manner: They prepared a penis of wood with bark wrapped around it, or merely twisted the front of their fiber-skirt into a protuberance, and walked through the crowd, poking those who had remained home between the legs, saying, "You are not a man but an alyha·". The alyha· themselves indulged in this practical joke, using mostly the above-mentioned stick, or an old club.

The alyha· and hwame· never went to war, although on occasion women insisted on accompanying a beloved husband or brother on the raid.

To call a person a "homosexual" when he is not, is a bad insult and is fiercely resented. The Mohave feel certain that a white woman whom they know and who is rather businesslike and intellectual is a hwame·. The expression "thou art a coward" (whose stem is alyha·) may be used however as a friendly taunt, or even as a joke.

The present writer's woman interpreter used to complain of his allegedly reckless driving and was called "malyhaek" by the author. She got even with him on one occasion, by inducing her cousin to drive the author and the main male informant, who were lying on the platform of an old truck, at top speed over impossible roads, shouting back at him "malyhaek". The male informant being equally afraid during that trip, author and informant kept on shouting at each other "thou art a coward" until we were all too hoarse from shouting and laughter to continue.

As a rule official homosexuals were not teased. The Mohave believe in temperamental compulsions and consider that "they cannot help it". The brunt of the inevitable joking was borne by their spouses who had no such excuse. "Kuwal married his alyha· wives because the transvestites are lucky at gambling and their luck extends to their spouses. He was a great gambler. But when people teased him about his alyha· wives he used to get angry." Some of them become so accustomed to having homosexual spouses that they don't care for normal spouses any more. We have already stated that alyha· perform fellatio. Yet when a woman asked Kuwal to allow her to perform fellatio upon him, he refused. "My penis got feelings", he objected. The woman became very angry and said, "You don't like me. You let other women (i.e. the alyha·) do it to you."

Yet, for reasons already described, alyha· had no difficulty in obtaining husbands. The essential adventuresomeness of the Mohave character, combined with their completely humoristic attitude toward sex, except where procreation is involved, together with the aforementioned reasons of economic comfort and convenience, induced many a man to become the spouse of an alyha· at least for a short time. After the dissolution of such union they could always find real wives.

Not so the hwame·. Even though women are more flighty and loose, according to the testimony of the Mohave, they were less willing

to live with a hwame·. This may not be entirely due to the fact that they did not derive complete satisfaction from digital manipulations. Men not seldom shunned them afterwards, especially because these hwame· were not always young and old women are supposed to have a *sui generis* odor. Even when a young man married an old woman people said to him, "Now no young woman will want you again. You will have the smell of an old woman about your person." Furthermore the physically weaker hwame· could not protect her by physical violence against the jests of the community. The lack of satisfaction from sexual relations without children, of whom the Mohave are inordinately fond, may have been an additional factor in the brittleness of this relationship.

Nor were homosexuals considered adequate spouses. "He must be awfully hard up to marry a womanly man", or, "No man must want her, so she went to live with a hwame·", were current comments upon such unions. Nor did the community set too much faith upon their sexual satisfactions. "What can be the matter with that woman? She is quite terrible. What does she think she gets from that hwame· husband of hers?" they said about women who married hwame·. As to men, who lived with alyha· people wondered if "they really thought they were having intercourse with a woman."

Perhaps because of the greater difficulty they experienced in finding a substitute, the hwame· were more devoted spouses than were the alyha·. Here again they conform to the current pattern of their adopted sex. Mohave men are more faithful than are women, and it appears from my suicide statistics[11] that women seldom, if ever, commit suicide over the desertion of a lover, even though they kill themselves more often—or rather try to kill themselves more often—than men do at the death of a spouse. They seem to be less ready to reconcile themselves to the inevitable.

Last of all the hwame· is not safe from being raped by a practical jester, especially when she is drunk, while drunken men are seldom raped by women.

Altogether it will become apparent from the two detailed case histories about to be quoted, that the lot of the hwame· is infinitely harder than that of the alyha·.

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[11] Devereux, George. Mohave Suicide. Typescript report in possession of the Committee for the Study of Suicide, Inc., New York City.

SOCIAL ASPECTS

Socially speaking Mohave civilization acted wisely perhaps in acknowledging the inevitable. This airing of the abnormal tendencies of certain individuals achieved several aims. It deprived certain modes of atypical behaviour of the glamour of secrecy and sin and of the aureola of persecution. It enabled certain persons swaying on the outskirts of homosexuality to obtain the desired experience and find their way back to the average tribal pattern without the humiliation of a moral Canossa. It created what is known as an "abscess of fixation" and localized the disorder in a small area of the body social. Last of all the very publicity given to their status did not permit homosexuals to insinuate themselves into the confidence of normal persons under false colors and profit by some temporary unhappiness of the latter to sway them. They had to compete with normal blatant sexuality not in the dark groves of Corydon and Sappho but in the open daylight, on the acknowledged playground of normal sexuality, i.e. at gatherings and feasts. This arrangement, while safeguarding homosexuals from the dangers of persecution, also made their unsuccessful courtships doubly painful because of the very publicity given to it. In creating metaphorically speaking, "reserved quarters", for permanent homosexuals and for the passing whim of bisexually inclined active male homosexuals and passive female ones, they gave the latter an opportunity to satisfy their passing longings, and left the door wide open for a return to normalcy.

As for the homosexuals, the alyha· poking cowards with a bark phallus and calling him a coward, only half realising his own awkward unhappiness, serves to epitomize the whole, rather sad, picture of the status of the homosexual in almost any society.

CASE HISTORIES

It may not be unnecessary to recall here that male homosexuals were allowed among many American Indian tribes to assume officially the status of a woman. Data are very incomplete however, and seldom include actual case histories. For that reason the following two case histories have been reported with every obtainable detail, in the hope that comparable data would be obtained from other native races.

Both case histories were obtained from the same male informant, who had known in his youth Kuwal very intimately and was also acquainted with Sahaykwisa whose adventures were common knowledge

at that time. He was one of the men who brought in her corpse after she was killed by drowning. Informant never had any homosexual experiences himself. The case histories were checked against the testimony of other informants, and all details were found to be correct.

Kuwal's picture may be seen in Kroeber's *Handbook of the Indians of California,* plate 65, (c), between pages 728-729. He was the last Mohave who wore a stick through his nasal septum.

The case of Kuwal

This case was reported to the present writer by the shaman Hivsu· Tupoma, who had known Kuwal in his youth.

"If you marry an alyha· you will have a hard time when you try leaving him, because he has the strength of a man and may beat you up," Kuwal told me once. Then he told me the following story:

"After I married that alyha· I went to a dance where I met a pretty girl who wanted to marry me. I liked her and flirted with her which made my alyha· wife angry. 'You carried on with me while I was having my menses and now I am pregnant', the alyha· said to me. So I continued to live with him, but carried on with the girl secretly. At last the alyha· found out about it and got very angry with me. I told him he could not bear a child anyway and went to live with my relatives.

"I had some trouble with my relatives too. I used to say when the women came near me, 'Phew, you smell like fish'. One day my hostess became very angry with me and began throwing things at me when I said it during breakfast. 'If we smell so bad you get out of here', she said. I ran away but later came back and continued to live with them. The alyha· went on looking for me and people warned me he would beat me if he found me. One day he came to the house and beat me so hard it almost laid me out. Having thus satisfied his revengeful nature he went home. I thought that this fight had appeased him and I left my relatives and went to live with that girl. A few days after my marriage the alyha· turned up at my house and wanted to fight with my wife. He was accompanied by a number of men who wanted to enjoy the sight. I was in the house and heard the noise of a fight. My wife and the alyha· were fighting in the yard outside. The alyha· was stronger than she was, being a man, but he pretended to be a weak woman and fought like women do. He did not use all his strength. He could have beaten up my wife quite easily, but he let my wife throw him several times. The men who had accompanied him were standing around snickering and shouting. They shouted to my wife, 'Be careful, *she* is with child and you might hurt the child'. My wife got very indignant and began shouting at them: 'Ah, just as you say. *She* is with child indeed. This thing here cannot have a child. *She* got a penis and testes.'

"The mother and grandmother of my wife who were sitting near by got very angry and shouted at the men, 'You brought *her* here because you knew that my daughter was no match for *her*.' 'If you throw *her* pull off *her* penis and testes',

they told my wife. When the alyha· heard these references to his genitalia he became very angry. He picked up a log from the camp-fire and almost succeeded in setting fire to the roof. Then he picked up a stick and tried to beat my wife with it. He might have killed her had not the men who came with him have interfered. I could not have interfered myself because a man should never mix in the quarrels of women. They got hold of the alyha· and led him away, comforting him all the while. 'You will find another husband,' they told him. They teased him the way men tease amorous women. They flirted with him."

Kuwal used to get quite melancholy when he recalled his real wife. "One time I really got a real woman and had a child by her, but the child died. Had the child lived I would now be living with it." Kuwal was very proud of having had a real child. It made him angry when people teased him and told him when he was with a crowd that he never had anything but alyha· wives. Kuwal's alyha· wives were mostly Yuma and only one of them was a Mohave. The Mohave one belonged to the Mu·θ gens. (The screw-bean gens.)

Kuwal used to get very angry when people kicked the dung of animals and said it was his children and told him he had believed his alyha· wives when they were pregnant with things stuffed under their skirts.

After a while Kuwal got himself another alyha· wife. This is the story he told me about that wife of his.

"I lived with that alyha· for a while, but someone succeeded in alienating his affection. Once the alyha·'s mind was made up to leave me, he began finding fault with me on every occasion. 'You copulate with me all the time,' he said. 'That ought to be enough for you, but when you go to gamble—which you do all the time—you also copulate with other women. You should be satisfied with me alone'. Of course the alyha· said all this only because he had made up his mind to leave me.

"In the end we went to a dance one night and the alyha· eloped with another man. I was glad to be rid of him, but thought I would pretend to be very angry, just for the sake of fun. I painted my face black, the way men on the warpath or husbands out for revenge do. Then I said: 'I will go after my *woman* and fight for *her*'. I just said it for fun, but a lot of men came with me to see what would happen. They said it would be very funny. We went to that man's house and I said to him, 'I came to fight for my woman'. At once we began to fight. The alyha· stood there looking at us, yelling and wailing like a woman. 'Peleleley!' the alyha· was yelling. The crowd was shouting lustily 'Pey-pey-pey!' They were enjoying themselves. 'Your penis is too short', the alyha· shouted. 'It is just like a clitoris'. When the men heard this they laughed. They shouted 'Pey-pey!' even louder. But the alyha· was getting very angry. 'When you were untrue to me, I did not quarrel with you, but now that I left you for another man you come and fight. Who do you think you are, anyway,' he said. The alyha· got so angry that he picked up a stick and fell foul on me, while I was fighting with *her* husband. But the men interfered, because they were afraid the stick would hurt me. They got hold of the alyha· and patted his buttocks, the way one pats a woman's buttocks. The alyha· began to giggle. 'Why don't you behave yourself,' he told them. 'Why do you try to put your hand into my

vagina?' At last her husband and I stopped fighting and we went home, quite exhiliarated with the fun we had."

I heard Kuwal tell me this story just as I told it to you. He is dead now. He was a close friend of mine and always told me stories about his alyha· wives.

The case of Sahaykwisa

This case was reported by Hivsu· Tupoma, additional data having been obtained from Tcatc.

Sahaykwisa, a full blood Mohave woman of the ñoltc gens was born toward the middle of the last century and killed toward the end of the century apparently at the age of forty-five. She was a shaman specializing in the cure of venereal diseases, and therefore was said to be lucky in love. She began to practice witchcraft at the age of twenty-five, but was not accused of it until five years later, according to some of the informants. She was said never to have menstruated, but was feminine in appearance and had large breasts. She wore a short skirt (erroneously described by one informant "like a man") and was "rich" enough to wear shoes. At that time Mohave women wore Mother Hubbards and went barefoot. The Mohave refer to her as *he*. With regard to the statement that she never menstruated it may not be unnecessary to state that if she did menstruate she would certainly have told no one about it. One of her former wives is still alive. Her name is ñoltc. She could not be consulted because she resents any allusion to her homosexual venture.

It is not clear whether or not Sahaykwisa had been initiated into the status of a transvestite. Opinions differ. At any rate she is consistently referred to as a hwame· which would suggest that she did submit to that ceremony.

Sahaykwisa had at a certain time a very pretty wife. Other men desired the woman and tried to lure her away from the hwame·. "Why do you want a transvestite for your husband who has no penis and pokes you with the finger?" they said. The wife, however, remained stubborn: "That is all right for me if I want to remain with her." Eventually the suitor gave up and left her alone. Soon another man began paying attentions to her, trying to induce her to leave the transvestite. "She has no penis, she is just like you are. If you remain with her no 'other' man will want you afterwards." Eventually the wife eloped with this man, because she liked him well, although her transvestite husband provided well for her, planting and doing all the man's work. (No man does feminine work, unless he marries an unmenstruated child, who does not know how to look after the household.) When Sahaykwisa's wife ran away, the transvestite began attending dances and flirted with the girls. A man who saw her flirt with them said chaffingly, "Why don't you leave those women alone? You cannot do anything with them anyway." Behind her back people nicknamed her Hiθpan kuðape, which means split vulvae, and refers to one of the postures female homosexuals assume during coitus. This is a bad insult and no one dared call her that to her face.

Despite all this banter the wife who had left the transvestite was less satisfied with her male husband and eventually returned to the transvestite. The man did nothing about it.

When the transvestite attended dances with *his* wife, he used to sit with the men and boast in a manly fashion, describing the genitalia of his wife. In the meantime people profited by it to tease the girl about her relationship with the transvestite, saying that Sahaykwisa had neither a penis nor testes. "If I don't copulate with you and your husband both!" one of them exclaimed. "She got just what you got. But don't tell your husband I told you so, because your husband will be angry with me." In the end the girl grew tired of being an object of derision. She told her husband about it. The transvestite became very angry, and told the girl to go away and leave the house. "If you tell me to go, I shall go," the girl said and left forthwith.

Eventually Sahaykwisa got herself another wife. People also teased this woman. In the meantime the girl who had been Sahakwisa's former wife got married again, but people still teased her and her male husband. "Just poke her with your finger, that is what she likes, use your finger, that is what she is accustomed to. Do not waste your penis on her," people advised the man. (The Mohave seldom practice digital intromission, because it makes the hands smell bad.) In turn Sahaykwisa's former wife teased the transvestite's present spouse. "I know very well what you are getting. She pokes her finger into your vagina. Mine still hurts because her fingernails scratched me." The transvestite's present wife complained to her husband, but all Sahaykwisa would deign to reply was, "Never mind what she tells you. She wants to come back to me, that is all". The wife insisted that that was not so, but Sahaykwisa told her that she knew better and let it go at that.

Eventually Sahaykwisa and her present wife met her former wife and the latter's husband at a dance. Again the former wife teased the present one. The latter felt that she had enough of it and wanted to fight. The men present encouraged the women who soon stopped exchanging insults and began to fight. The husband and the transvestite both remained seated in the very dignified posture befitting men when women fight over them. The crowd, however, jeered at Sahaykwisa. "The hwame' is proud now. She thinks perhaps she got a penis." At last a practical joker pushed the fighting women on top of Sahaykwisa and the three of them rolled about in the dust. Some time afterwards the transvestite's wife felt she could not bear the jesting any longer and deserted her *husband*.

Sahaykwisa was very much disappointed and grew resentful. She painted her face black, as befits a warrior on the warpath or a man about to track down the seducer of his wife. She also took her bow and her arrows and went away. She must have had another woman on her mind, for instead of going to the house of the unfaithful wife, she visited another camp where she met with a very bad reception. The woman she wanted to visit jeered at her, and addressed her as one woman addresses another woman. "She thinks maybe that bows and arrows suit her. She thinks she is a man". Sahaykwisa was unruffled. "Yes, I can shoot game for you," she said and left. She felt encouraged because the Mohave say that if a girl insults her suitor, the latter may be certain that he will win her in the end. A few days later Sahaykwisa visited that woman once more and asked her to grind corn for her, which is what young brides do as soon as they got married. Surprisingly enough the woman complied with this request. The news spread like wildfire. "I bet she will get herself another wife.

What can be the matter with these women to fall for a transvestite?" people commented. Indeed, the third time Sahaykwisa visited the woman she eloped with her, leaving her husband for the sake of the hwame·. The husband, a man of about thirty-five years of age called Haqau did nothing about it. "He could not very well fight with a transvestite," informant commented.

Sahaykwisa's ability to obtain wives did not surprise the tribe. She was, it must be remembered, a shaman curing venereal diseases, and by definition lucky in love. Apart from that magical luck she earned considerable money by her practice of "medicine" (and by prostitution to the Whites, certain informants assert). At any rate she was a good provider, worked hard and took great pleasure in bedecking her wives with beads and pretty clothes.

In the end the third wife abandoned her too and returned to her former husband. Haqau took her back, not without some hesitation, "because she had lowered herself by becoming the wife of a transvestite." In addition to that people warned Haqau that he was in danger of being bewitched by Sahaykwisa who was now a full-fledged shaman, and one frequently accused of witchcraft. "She will get even with you," people said.

Sahaykwisa lived on the southern outskirts of the town of Needles, while Haqau and his wife lived on the northern fringe of that town.

Once more Sahaykwisa picked up her bow and arrows and went to the camp of Haqau. She did not enter it however. She stood at a certain distance from it, looking at the camp. She did this several times, thinking of how she could bewitch the girl. People noticed her and realized what sort of mischief she was up to. They warned Haqau, but the man was not afraid and took it in a spirit of jest. "Let her come", he said. "Next time she comes I will show her what a real penis can do." The next time he ambushed her in the bushes, tore off her clothes and raped her. Then he left her in the bushes and returned to his camp. Sahaykwisa stood up and left without a word.

Never again did Sahaykwisa take a wife. By that time she had already bewitched several women she was in love with and segregated their ghosts at "her own place" where she had intercourse with them in her dreams, in the approved Mohave witchcraft fashion.

After her rape by Haqau she became a drunkard and began craving men. Not seldom, when she was drunk, some men dragged her to a convenient place and farmed her out to various men, including certain Whites, at so much the intercourse. By that time she was on the down grade and considered fair game, in the way lewd women (kamaloy) are. She fell in love with an elderly man by the name of Tcuhum, who belonged to her own gens (ñoltc). Tcuhum, however, refused to have intercourse with her. "You are a man," he said. Thereupon she bewitched him, because she loved him and wanted to have intercourse with his ghost in her dreams. Tcuhum died without confessing who had bewitched him—"he wanted to become her victim" people commented, referring to certain Mohave beliefs on witchcraft. Then Sahaykwisa started an affair with Tcuhum's son Suhuraye, aged about forty or forty-five. She had an affair at the same time also with a friend of Suhuraye, a certain Ilykutcemiðo·, of the o·tc gens, aged fifty. The three of them took a trip together to a certain place about thirty miles north of Needles and worked there.

By that time Sahaykwisa began to long for her beloved victim's company, and like most Mohave bewitchers she began to look for a chance of being killed, for only a murdered shaman will join the ghosts of his victims in the other world. She used to get drunk, and while under the influence of alcohol she used to tell of the people she had bewitched. During that trip she became drunk again and told her lovers how she bewitched Tcuhum. She boasted of it until the two men picked her up and threw her into the Colorado river where she drowned.[13]

At that time Hivsu· Tupoma, the writer's informant lived at Needles. Two weeks after the killing people saw buzzards on the sandbank and, after investigating, they discovered the partly decomposed body of Sahaykwisa. Informant and a number of others brought the corpse back to the Mohave settlement and cremated it in the customary fashion. People thought for a while that she had jumped into the river while she was drunk. But even when they found out that it had been murder no one did anything about it, because witches should be killed, and witches *want* to be killed anyway.

It is said that Sahaykwisa never bewitched her next of kin, as most shamans do, but Tcuhum at least was a member of her own gens. I have pointed out elsewhere the connection between witchcraft, incest and suicide in Mohave belief.[14]

NOTES ON OTHER TRIBES

Data on other Yuman tribes are scanty or non-existent. The following divergencies from the Mohave pattern may be noted.

The Maricopa (and other tribes of the Gila River who speak Yuman languages ?) believe in a mountain inhabited by a Homosexual Supernatural. This mountain gambles with a Homosexual Mountain of their arch-foes, the Yuma, and a human male belonging to the tribe protected by the losing mountain becomes a homosexual. The Yuma and Maricopa when they drew up in battle-formation called each other women or homosexuals. One becomes a homosexual by dreaming of the Homosexual Mountain. Men approve of male transvestites, but they make women uneasy. (SPIER, LESLIE. Yuman Tribes of the Gila River, *Chicago*, 1933, pp. 6, 242-243.)

The Northeastern and Western Yavapai know only of a Tonto transvestite of whom they claim to be afraid. (GIFFORD, E. W. The Northeastern and Western Yavapai. *University of California Publications in American Archaeology and Ethnology*, vol. 34, 1936, p. 296.)

The Cocopa female transvestites had their noses pierced. Except for their genitalia their bodies had a male appearance. They fought in battles. (GIFFORD, E. W. The Cocopa. *University of California Publications in American Archaeology and Ethnology*, vol. 31, 1933, p. 294.)

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[13] DEVEREUX, GEORGE. Mohave soul concepts. Cf. footnote 8.

[14] DEVEREUX, GEORGE. Mohave Suicide. Cf. footnote 11.

The Kamia believed in a transvestite culture-hero who taught them agriculture. (GIFFORD, E. W. The Kamia. *Bureau of American Ethnology*, Bulletin 97, 1931, p. 12.)

The Yuma female transvestites had either undeveloped or male secondary sex-characteristics. They dreamt of weapons. (FORDE, C. DARYLL. *Op. cit. University of California Publications in American Archaeology and Ethnology*, vol. 28, 1931, p. 157.) Their creation myth contains an incident in which a male inserts his penis into the woman's anus, and, upon being urged to insert it into her vagina, inserts his testes into her vulva. (HARRINGTON, J. P. A Yuma account of origins. *Journal of American Folk-Lore*, vol. 21, 1908, p. 334.)

The rest of the data corroborate our Mohave data. In every instance the attraction of the occupations of the opposite sex is stressed.

LENGTH OF LIFE IN ENGLAND, 1250-1348

BY JOSIAH COX RUSSELL

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I

IN THE field of medieval population one of the worst gaps is the absence of studies upon the length of life.[1] One reason for this lack is the apparent disinterest of medievalists in this intellectual area.[2] A second reason is the scarcity of sources for such studies. The medieval period has left us with much evidence of births and deaths, but it is somewhat scattered and will require much careful painstaking research before definitive results are secured. One relatively large body of such data which is not only in existence but even in print throws much light upon the length of life in England after 1250, the *Inquisitions Post Mortem* and a related group published with them, the Proofs of Age.[3] These have been used frequently for genealogical purposes.

The period, 1250-1348, is chosen primarily for two reasons. It is placed as far back as possible within the limits of the evidence in order that there may be data in regard to expectation of life and distribution of population as early as possible in the Middle Ages. There are studies upon length of life and similar questions for the Roman period and, of course, for more recent times.[4] The period, 1250-1348, presents no real

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[1] For a short survey of the field of medieval population see my article of that title in *Social Forces*, 15 (May, 1937), 503-11; or the article, "Popolazione" in the Enciclopedia Italiana (1936).

[2] As may be seen in the Progress of Medieval Studies in America, 12th report, J. F. Willard (ed.), (*Boulder, Colo.*, 1935).

[3] Calendarium Geneologicum, Henry III and Edward I, Charles Roberts (ed.), (*London*, 1865); Calendars of Inquisitions Post Mortem, etc., many volumes.

[4] The data on this subject are given in Dublin and Lotka, Length of Life (*New York*, 1936), pp. 32-40 and literature cited there. On Roman conditions see also A. G. Harkness, "Age at marriage and death in the Roman Empire," *Transactions of the American Philological Association*, 27 (1896), 35-72.

demographic complications in the form of great plagues, droughts, or even extended wars in Europe. The number of inquests *post mortem* varies considerably in the period 1272-1348 from a low of 18 for 1285-6 to 104 in 1327-8. The highs of some years tend to be offset by the lows of others. The average of the years 1272-90 is about 45; an abrupt rise occurs to about 70 which remains the average until 1348. It is probable that both the differences from high to low and in the two averages may have been due to administrative methods and practice rather than to notable changes in mortality. The first year of the Black Death sent the mortality to 363.

The *inquest post mortem* must be explained. It is the report of evidence taken by royal officials in regard to the property and heirs of deceased persons who held directly of the crown, permanently or temporarily. Since many persons of even considerable wealth held of other lords the list does not include all of the wealthier persons of England. Of course large numbers of lesser persons never appear at all. The 45 or 70 people dying each year must have been a very small proportion of the total annual dead since England's population at the time was probably two million, at least. Furthermore, the men are preponderantly represented in the records. Because the few women represent an unusual group they are excluded from consideration in the estimates upon length of life. The results of evidence based upon these inquests is a picture of the mortality of the upper class masculine element.

The inquest gives the age of the heir but not the age of the deceased. This must be secured by calculation from his age at the death of his predecessor. Royal officials desired to know the name and age of heirs; if they were under age (21 for men and 14 for women) the crown was entitled to rights of wardship and marriage. If the heir died before coming of age, his death does not seem to be recorded in an inquest. Since the age of the heirs was important, especially if young, the records are probably accurate. We see that for heirs more than a few years over 21 there is a tendency to assign the nearest round number; ten years, five years, or even numbers. Since a high proportion of heirs were under 30 we can assume that their ages are reasonably accurate.

To secure the age at death the age of an heir must be secured and then added to the years intervening before his death. Both factors being fairly accurate, we have better, although more complicated, data than if the age at death were given. The use of two inquests to determine the

age at death creates the problem of identification, with its dangers of confusing two men of the same name and of grandson with son. To some extent both of these dangers can be guarded against. The inquests give the county or counties in which the lands of the heir lies which helps to identify men of the same name. By noting the age of the men confusion between son and grandson is somewhat avoided. In general, the dangers of confusion though present are probably not serious.

It will be noticed that occasionally jurors from different counties return quite different ages for heirs, thus tending to cast suspicion upon data from single counties since conflicting evidence does not make evidence based upon single statements more authoritative. Yet in this case the reason for divergence is clear: the jurors in counties in which the heir does not live are often uncertain about his age and say so.[5] We are justified in believing that evidence from a single county, that of a man's neighbors, is probably accurate.

The period covered by this study is from the appearance of the earliest inquests *post mortem*, about the middle of the thirteenth century, to the Black Death which occurred in England in 1348. In order to eliminate the effects of this plague it is necessary to set the time limit for selecting heirs for study far enough ahead of 1348 to permit them to die by that time. For this purpose we have chosen 1307 even though a few young heirs of the period just before that date may have lived past 1348. The great age of the few who survived is probably offset by the confusion of an occasional grandfather with a father which we have failed to distinguish.[6]

II

In all, 581 cases were secured, and upon them are based the following studies of condition of population. First, the data were arranged in a life table, which is given below (Table 1). The process, since the number of cases studied is relatively small, is very simple. For each year of life it gives the number of deaths, the total persons alive, the

[5] "Nec de eius etate, dicunt quod nihil sciunt eo quod natus fuit in partibus longinquis," Cal. Gen. I, 526.

[6] It is inadvisable to include all the data upon which the following calculations have been based. The material will be prepared in triplicate and will be available upon request for anyone who desires to examine the methods and results at first hand.

TABLE 1

Life Table

AGE	NUMBER OF DEATHS IN YEAR	TOTAL ALIVE	TOTAL YEARS TO LIVE	EXPECTATION OF LIFE
100	1	0	0	0
89	1	1	11	11
87	1	2	15	7.5
84	1	3	24	8
82	1	4	32	8
81	1	5	37	7.4
80	3	8	45	5.6
79	2	10	55	5.5
78	1	11	66	6
77	5	16	82	5.1
76	2	18	100	5.5
75	5	23	123	5.3
74	5	28	151	5.4
73	2	30	181	6.0
72	3	33	214	6.5
71	5	38	252	6.6
70	8	46	298	6.5
69	6	52	350	6.7
68	11	63	413	6.6
67	6	69	482	7.0
66	12	81	563	7.0
65	12	93	656	7.1
64	11	104	760	7.3
63	8	112	872	7.8
62	8	120	992	8.2
61	9	129	1121	8.5
60	10	139	1260	9.1
59	12	151	1411	9.3
58	17	168	1579	9.4
57	21	189	1768	9.4
56	20	209	1977	9.5
55	18	227	2204	9.7
54	11	238	2442	10.3

TABLE 1 (*Continued*)

AGE	NUMBER OF DEATHS IN YEAR	TOTAL ALIVE	TOTAL YEARS TO LIVE	EXPECTATION OF LIFE
53	12	250	2692	10.7
52	17	267	2959	11
51	13	280	3239	11.5
50	11	291	3530	12.1
49	13	304	3834	12.6
48	17	321	4155	12.9
47	10	331	4486	13.5
46	10	341	4827	14.1
45	10	351	5178	14.7
44	18	369	5547	15.0
43	16	385	5932	15.4
42	16	401	6333	15.8
41	9	410	6743	16.4
40	11	421	7164	17.0
39	16	437	7601	17.4
38	8	445	8046	18.1
37	8	453	8499	18.8
36	14	467	8966	19.2
35	10	477	9443	19.8
34	12	489	9932	20.3
33	9	498	10430	21
32	11	509	10937	21.5
31	5	514	11453	22.3
30	9	523	11976	23
29	7	530	12506	23.6
28	7	537	13043	24.3
27	13	550	13593	24.7
26	6	556	14149	25.4
25	2	558	14707	26.4
24	5	563	15270	27.1
23	8	571	15841	28
22	7	578	16419	28.4
21	3	581	17000	29.3

total years which the group was to live and the expectation of life. The last figure is the dividend of the third by the second figure.

The results of these data in terms of expectation of life are given by the heavy unbroken line in Fig. 1. For the sake of comparison there

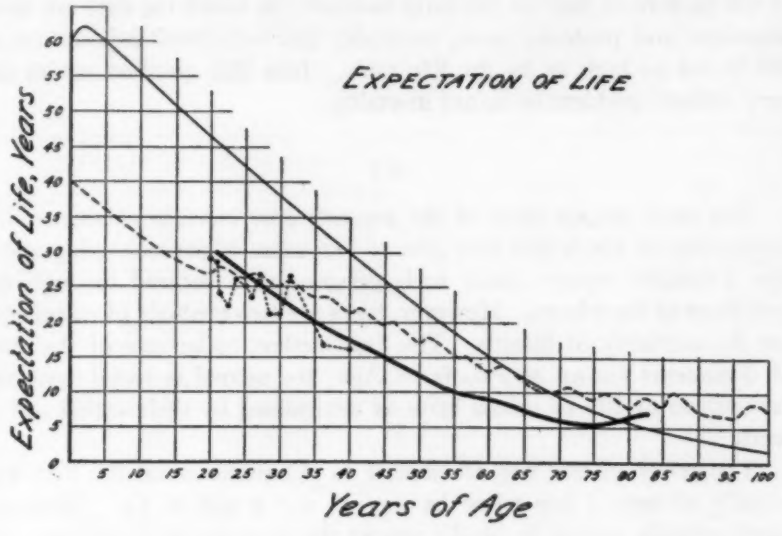

FIG. 1

———— United States, Males, 1929-31. From Dublin and Lotka, *Length of Life*, pp. 14-15, 38.

– – – – Roman provinces, Hispania and Lusitania. Dublin and Lotka, *op. cit.*, p. 38. (As adapted from W. R. Macdonell, "On the expectation of life in Ancient Rome, etc." *Biometrika*, 9 (1913), 373).

———— England, Males, 1250-1348. From Table 1.

—·—·— England, 1250-1348. Actual expectation of those who fell heir at specified age.

are given also the lines for expectation of life among males in the United States in 1929-31 and for one calculation for expectation of life in the Roman provinces of Hispania and Lusitania.[7] Of course the data in the medieval table for the age of about 75 and beyond are so few that the results are extremely doubtful. Otherwise the medieval expectation

[7] Dublin and Lotka, *op. cit.* pp. 14-15, 38.

seems to have been, except for the years under 25, rather less than that of the Roman provinces.

Another method of calculation of expectation of life from the inquests is to determine the average duration of life for the group falling heir at a particular age. The heavy dots in Fig. 1 give this calculation. It will be noticed that for the early twenties (in which the data are more abundant and probably more accurate) the calculated expectation of life is not as high as by the life table. Into this question comes the very difficult problem of infant mortality.

III

The most serious fault of the inquests *post mortem* as sources for expectation of life is that they give so few cases of persons dying under age. Probably reports about such persons were secured through the guardians of the minors. However, there are two methods of calculation for the mortality of infants. The first method makes use of the class of documents known as Proofs of Age; the second is based upon the expectation of life of minor heirs as determined by their actual age at death.

The proof of age was an inquest to determine when the heir was actually of age: a boy when he was 21 and a girl at 14. These inquests usually appear in blocks among the inquests *post mortem*. At the inquest for proof of age various persons who were acquainted with the heir gave a statement of the heir's age and explained how he remembered the heir's birthday. Many remembered because their own children were born at the same time. Since the proof was usually taken just after the heir had come of age, these recollections should give some clues to infant mortality.

One drawback to the use of these proofs is that the persons who testify, although mostly substantial people, were generally not of as wealthy a class as those who figure in the inquests *post mortem* upon which the data for expectation of life were based. Their life was not probably harder than that of the others, and the infant mortality was probably no higher.

These proofs of age provide many hundred instances of recollections of births: nearly 600 (actually 597) are used in this study. There are some complications in the use of the data of the proofs, largely because of the nature of the phraseology. The reference numbers are to Table 2.

In two cases the situation is clear: those statements which show beyond doubt that the child was alive at the time when statement was made and thus would be 21 (1) and those which show that he was dead (4). The statement (2) that the witness "has a child" is taken to mean that the child is still alive, since in all cases, 61 at least, in which the child's status is clearly given, he was alive. Thus 83 (144—61) are added to the group that lives to 21.

TABLE 2

(1)	Listed as alive, on evidence	213
(2)	"Has a child"	144
(3)	Number in 2 not in 1	83
(4)	Listed as dead, on evidence	74
	"Had a child"	
(5)	Alive, in 1	56
(6)	Dead, in 4	17
(7)	Uncertain	106
(8)	Number of 7 assumed to be alive	81
(9)	Number of 7 assumed to be dead	25
	"Was born"	
(10)	Alive, in 1	100
(11)	Dead, in 4	7
(12)	Uncertain	108
(13)	In 7	11
(14)	Number in 13 assumed to be alive	9
(15)	Number in 13 assumed to be dead	2
(16)	Number in 10 and 14	109
(17)	Number in 11 and 15	9
(18)	Number in 12 assumed to be alive	100
(19)	Number in 12 assumed to be dead	8
(20)	Total estimated alive: 1, 3, 8 and 18	477
(21)	Total estimated dead: 4, 9, 19	107
(22)	Per cent dead: $21 \div 20$	22.4
(23)	Per cent dead: $4 \div 1 + 3$	25

At first glance it might seem that the statement, "He had a child who was born" could only mean that the child had died in the meantime. However, other evidence (1 and 4) shows that actually 56 were alive and 17 dead (5 and 6), leaving 106 whose status was uncertain (7).

Assuming that the proportion of dead and alive was the same for the undetermined group as for the others would give 81 alive (8) and 25 dead (9).

The statement that "The child was born" involves even more complicated calculations. In general the method is the same as that followed above. The underlying assumption is that the ratio of living and dead is the same for the undetermined group as for those whose state is known.

For the more complicated calculation (22) there would seem to result a mortality of 22.4 per cent by the age of 21 or thereabouts. A less complicated calculation comes from dividing the number of those who are quite evidently dead by the number of the living (23) which gives a mortality of approximately 25 per cent. These calculations involve a very interesting problem. Would fathers be apt to remember better the births of children who were living than those who were dead?

Assuming that the larger of the estimates (25 per cent) is correct, by the age of 21 then one-third of 581 or 194 must have died. Let us further assume that on the average there were about 7 deaths a year from 6 to 20, 12 from 1 to 5, and 39 in the first year. How would this hypothetical table look? It would be a continuation of Table 1 and would have the following expectations at the various ages:

Age	*Expectation of life*	*Age*	*Expectation of life*
21	29.4	10	36.4
20	30.1	9	37.0
19	30.7	8	37.6
18	31.3	7	38.3
17	32.0	6	38.9
16	32.6	5	39.4
15	33.3	4	40.1
14	33.9	3	40.4
13	34.5	2	40.7
12	35.1	1	41.1
11	35.7	0	40.0—

The broken line continuing the line of the life table calculation in Fig. 2 shows the curve of this estimate.

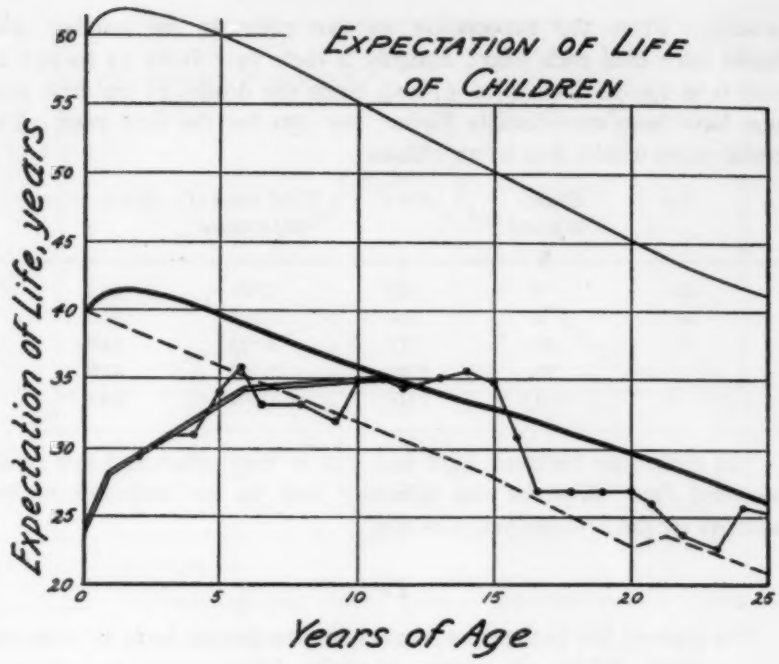

FIG. 2

United States, Males, 1929-31 (as in Fig. 1).

Roman provinces, Hispania and Lusitania (as in Fig. 1).

England, 1250-1348. Based upon proofs of age and hypothetical annual mortality.

England, 1250-1348. Actual expectation of those who fell heir at designated year, smoothed for five years.

England, 1250-1348. Hypothetical line based upon previous data.

This calculation provides an estimate slightly better than that of the Roman provinces; it is much higher than that of the calculations from the actual age of death of minor heirs, an estimate which is probably too high since it apparently excludes the deaths of those who died before attaining their majority. We must, I believe, assume that 25 per cent is an optimistic estimate. Probably fathers remembered the birthdates of living children much better than those of the dead.

Suppose, however, we assume that the estimate of expectation of life based upon the age at death of those who were heirs when minors is

accurate. From the expectation we can calculate the number who should have died each year: roughly 2 each year from 14 to 21; 22 from 6 to 13; 70 from 1 to 5; and, since the deaths of the first year must have been considerably higher, say 150 for the first year. The crucial years would thus be as follows:

Age	*Deaths in years*	*Alive*	*Total years of expectation*	*Expectation*
20	2	583	17681	30.3
14	2	595	21221	35.7
6	22	771	26793	34.8
1	70	1121	31698	27.8
0	150	1371	33069	24.1

The difference between 1371 and 755 is very great and not easily accounted for. Most of the difficulty falls in the estimates or the mortality of the first ten years of life.

IV

The span of life is the time it takes for the human body to wear out from senility. While, of course, it varies from person to person a general statement can be made both for those of extreme longevity and for the average persons.

While the expectation of life is obviously greater today than for this period of the Middle Ages, the latter has some examples of persons of great age which seem well authenticated. Table 1 shows nine persons living past the age of 80, one to the age of 100.[8] The inquests *post mortem* mentioned another instance which fell outside of the group under consideration.[9] Both of these were men: one woman, Alina la Mareschal, was an heiress at "ninety and more" and died seven years later.[10] These are sufficient to show that the medieval man was capable of attaining the century mark, even if few actually did reach it.

The number of annual deaths shows some light upon the problem of the span of life. This is given in Fig. 3. There the difference between the medieval and modern rates of death stands out. The modern annual death rate rises very gradually from ten to fifty, quite

[8] Reginald of Colewyk, Cal. Gen. I, 270: Inquests Post Mortem.
[9] Thomas Slene. Calendar of Inquests Post Mortem, III, 332.
[10] Cal. Gen. I, 111, 148.

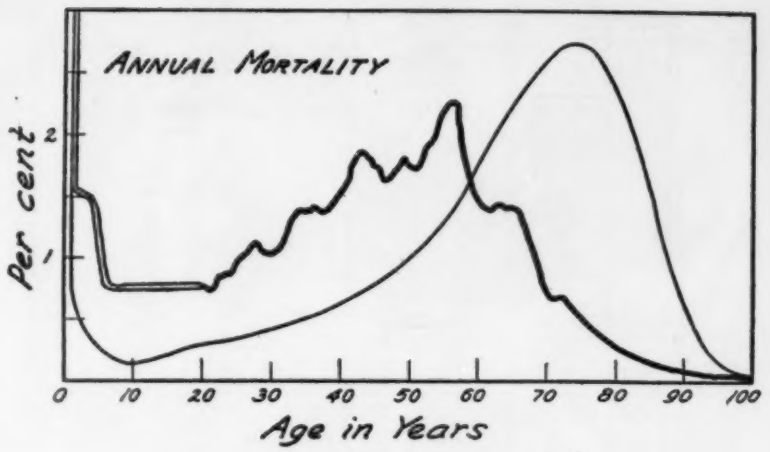

FIG. 3

United States, Males, 1929-31. From Dublin and Lotka, *op. cit.* pp. 14-15, 19.

England, 1250-1348. From Table 1. Smoothed over five years.

Hypothetical line based upon proofs of age.

sharply from fifty, reaching its peak just before 75 and then falls off steeply to 95. The medieval rate seems to rise evenly from twenty reaching its peak at about 57 and then falls off sharply to 80. In both cases it is difficult to credit the bulk of deaths in the peak years to other than senility. That is to say, not only the expectation of life but the life span itself has actually increased. To estimate from Fig. 3, it would seem that this increase amounted to about fifteen years.

Since only about thirty generations of persons have lived since this time the likelihood of such a marked change in the biological condition of the human race in England seems improbable except as the result of a catastrophic development. But since a great catastrophe did occur in the Black Death the possiblity of such radical increase in the length cannot be set aside until its effects are carefully studied.

V

Upon the basis of the data in the life table it is also possible to estimate the distribution of population by age, at least from the age of ten or thereabouts. This is attempted in Fig. 4. The arrangement is by

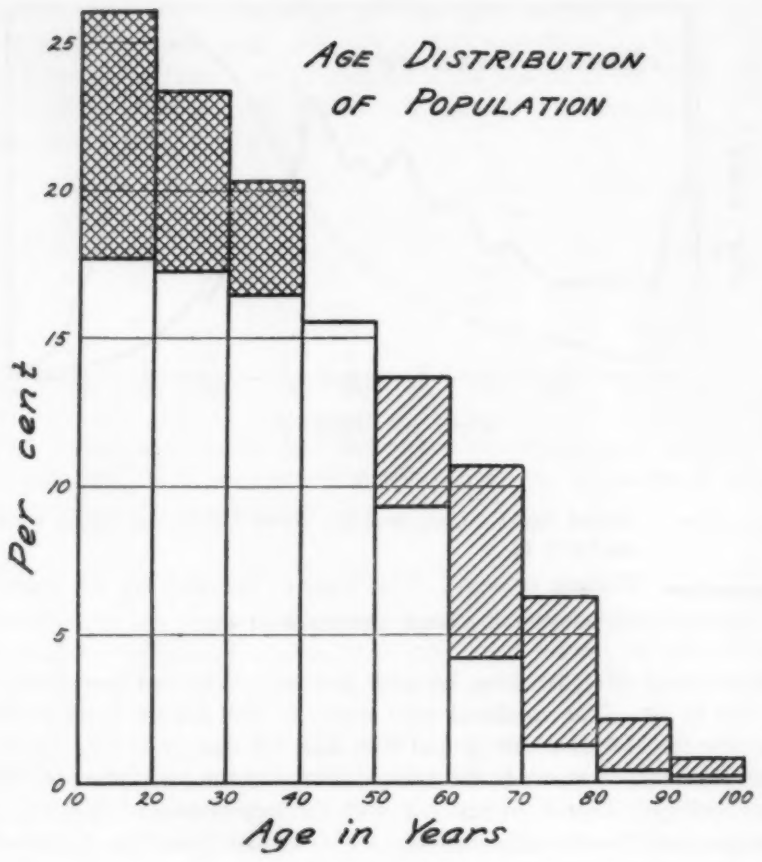

FIG. 4

Medieval excess of persons, 10-40, over modern (double cross hatching). Modern excess of persons above 50 over medieval (single cross hatching).

proportion of population to each ten years of life. That is to say, the life table as a whole gives a picture of the age distribution of population at the time. We assume that the number of living for the year in each decade that ends with a 4 is probably a fair median of the total. The assumption for the age of 14 is that the number of living was about 631.

With the medieval estimate is the proportion based on the modern situation, from a curve of survivors. Again the median is assumed to be the number ending in 4 for each decade. The contrast between the

two sets of figures is rather remarkable. The society of 1250-1348 possessed a much higher proportion of persons below forty, approximately the same proportion for the decade of the forties, and many fewer older than fifty. Of course if the proportion of young children were added the difference between the two periods in population distribution would be even more marked.

SUMMARY

1. The expectation of life of Englishmen of means of 1250-1348 was about as great as that of the Roman provincial of Spain or Lusitania thirteen centuries earlier although nowhere so great as that of today.

2. The evidence for mortality of children is too uncertain for very definite results and thus it is difficult to establish the mean length of life.

3. The curve of annual mortality would seem to suggest that the span of life was shorter in 1250-1348 than at the present time.

4. The distribution of population by age was markedly different then than today: the medieval population had a much higher proportion of persons under 40 and a lower proportion of people over 50.

QUANTITATIVE BEHAVIOR DATA AND THE LONGITUDINAL METHOD THE MORO REFLEX

BY MYRTLE B. McGRAW

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THE purpose of the present study is to illustrate certain advantages of the longitudinal method in studying behavior development provided intensive measurements or observations are made. Selection of the most efficacious frequency for making measurements offers a chronic problem for all experimenters, and an especially acute one for students of growth phenomena. Superiority of the longitudinal method (i.e. repeated measurements upon the

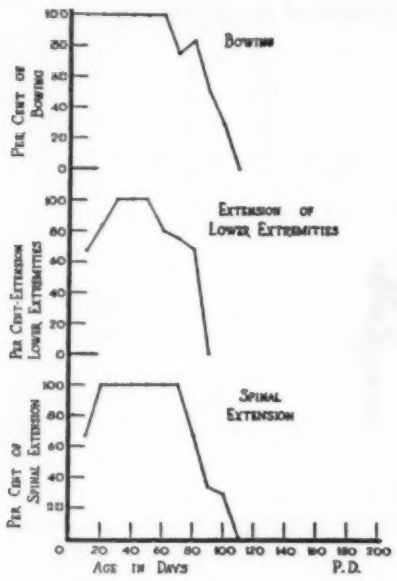

FIG. 1

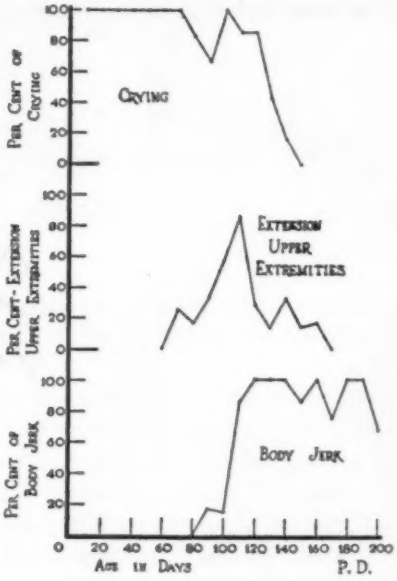

FIG. 2

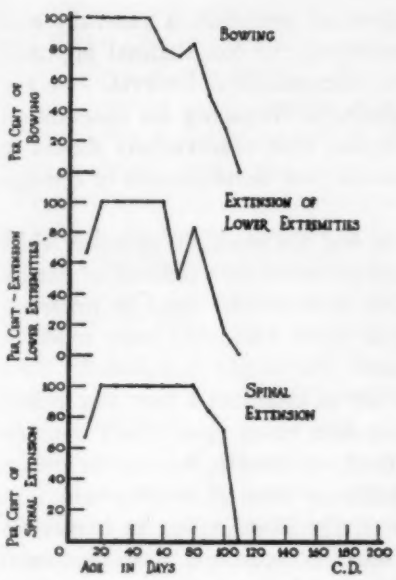
Bowing
Per Cent of Bowing
Extension of Lower Extremities
Per Cent - Extension Lower Extremities
Spinal Extension
Per Cent of Spinal Extension
0 20 40 60 80 100 120 140 160 180 200
Age in Days
C.D.

FIG. 3

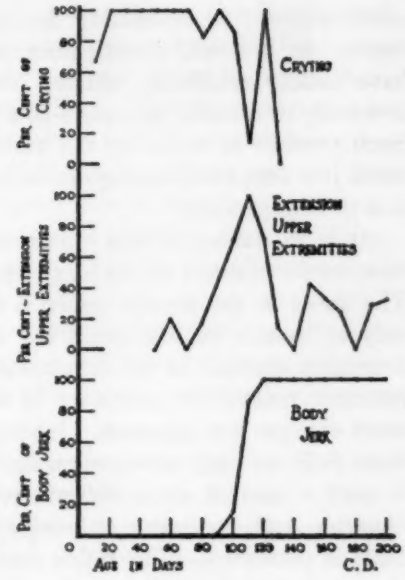
Crying
Per Cent of Crying
Extension Upper Extremities
Per Cent - Extension Upper Extremities
Body Jerk
Per Cent of Body Jerk
0 20 40 60 80 100 120 140 160 180 200
Age in Days
C. D.

FIG. 4

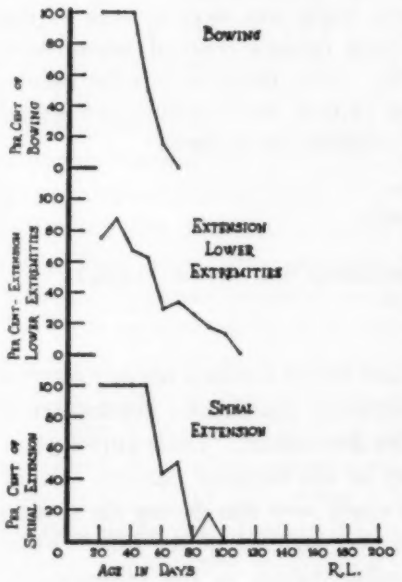
Bowing
Per Cent of Bowing
Extension Lower Extremities
Per Cent - Extension Lower Extremities
Spinal Extension
Per Cent of Spinal Extension
0 20 40 60 80 100 120 140 160 180 200
Age in Days
R.L.

FIG. 5

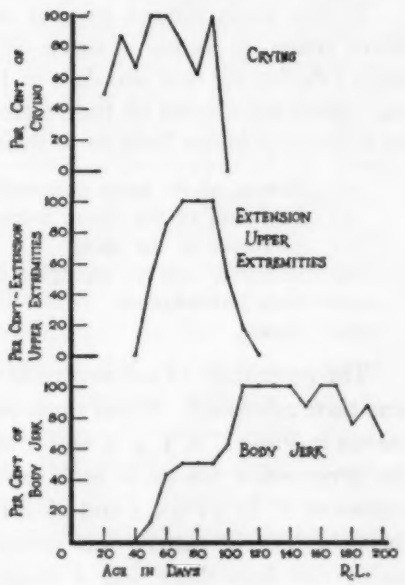
Crying
Per Cent of Crying
Extension Upper Extremities
Per Cent - Extension Upper Extremities
Body Jerk
Per Cent of Body Jerk
0 20 40 60 80 100 120 140 160 180 200
Age in Days
R.L.

FIG. 6

same subjects) in delineating developmental processes is generally conceded. In practice, investigators employing the longitudinal approach have usually arbitrarily selected some chronological interval,—weekly, bi-weekly or monthly periods,—as a desirable frequency for observation. Such practice is based on the assumption that observations should be made just frequently enough to include all new developments or changes in a growth process.

It is the fallacy of this assumption and the resultant practice which have rendered much of the longitudinal behavior data difficult to handle. The thesis of the present paper is that observations must be made not only to include all new items but with great frequency even when no detectable changes in the developmental process are manifested. Such intensive records are necessary in order to establish a base line before overt changes are apparent. Intensive data based upon direct observations yield not only curves showing trends of growth, but can be treated in such a manner as to indicate velocity or rate of development. To illustrate such treatment an analysis of the Moro reflex in human infants is presented. This reflex was selected because it undergoes rapid change during the early months of life and because components of the activity are easily detected and can be treated separately.

In this study cinema records were made five days a week of the Moro reflex as shown in three different infants (two of whom were twins) during the first 200 days of life. From these records the following significant aspects of the reaction pattern were selected and scored on a plus and minus basis as to their presence or absence:

(a) Bowing of the upper extremities
(b) Extension of the lower extremities
(c) Extension of the spine
(d) Extension only of the upper extremities (i.e. without bowing)
(e) Body jerk response
(f) Crying

The percentage of occurrence of each aspect within a ten day interval was then calculated. From these percentage calculations developmental curves in Figs. 1, 2, 3, 4, 5, and 6 were determined. These curves show the progressive change in each aspect of the behavior pattern. In the curves of P. D. (Figs. 1 and 2) it is easily seen that during the first 60 days the bowing pattern was present 100 per cent of the time. From 60 to 110 days there was a progressive decline in the frequency of bowing. From 60 to 165 days mere extension and abduction were the

more characteristic reaction of the upper extremities. The "body-jerk" phase began at about 80 days and continued to increase in frequency until 120 days, at which time it had become stabilized as the more characteristic reponse to stimulation of this order. From these curves it is easily seen that in the case of P. D. the period from 60 to 120 days constitutes a definite transition phase. It would be safe to assume that during this transition period some reorganization of the nervous system, especially in the centers governing this type of behavior, must be taking place. By the time the baby is about 4 months old the neural reorganization has become essentially complete. Fluctuations in the "body jerk" curve of P. D. after 140 days do not represent developmental changes *per se,* but are an indication of the baby's adaptation to the particular stimulus used. A less familiar sudden stimulation would still elicit the body jerk response.

The curves of C. D. (Figs. 5 and 6) almost parallel those of his twin, P. D. While the curves of R. L. show the same general trend as those of the twins he was slightly younger when the bowing began to fade and the body jerk response began to manifest itself.

The advantage of breaking a pattern of activity into component parts and plotting the developmental course of each aspect is readily demonstrable. In this way the time relationship between the various components is detectable. Curves illustrating "bowing of upper extremities", "extension of lower extremities" and "extension of the spine" show the same general trend in all three subjects. These factors are the early ones which compose the classic Moro reflex. Diminution of all three items is manifested at approximately the same time. "Crying" likewise is associated with the early form of the behavior pattern. It is noted that the "body jerk" phase does not ordinarily appear until the bowing is fading. "Extension of the upper extremities" is in fact a continuation of the early activity of the arms, involving the "bowing" phase, but it so distinctly represents the transition phase that it has been plotted separately. The distinct disadvantage of handling behavior data in this fashion is that it is recorded on a plus and minus basis. Such sharp distinctions never actually occur in a process of development. So far in studies of this order it has not been feasible to measure differences in degree. Despite this acknowledged handicap the method has undeniable promise in showing relations of component parts in a particular behavior pattern as development proceeds.

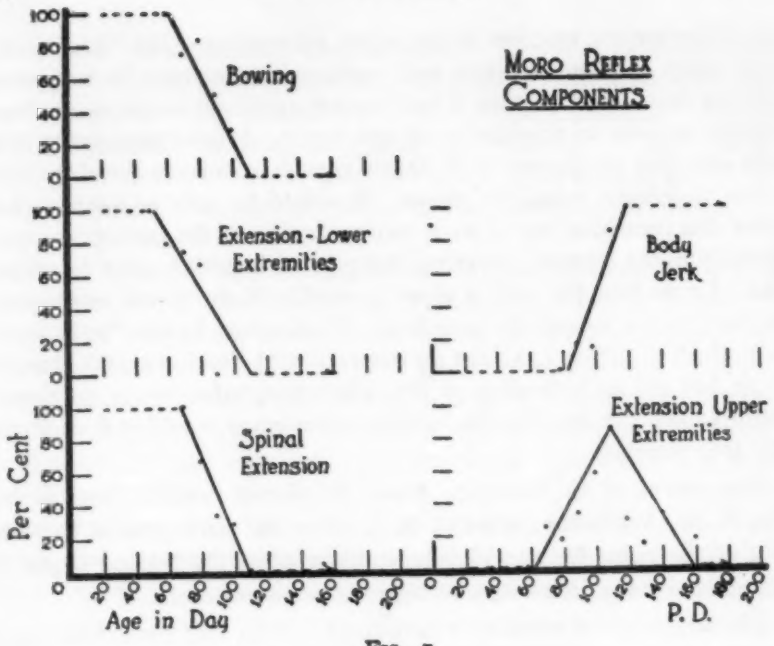
Moro Reflex Components
Bowing
Extension-Lower Extremities
Body Jerk
Spinal Extension
Extension Upper Extremities
Per Cent
Age in Day
P. D.

Fig. 7

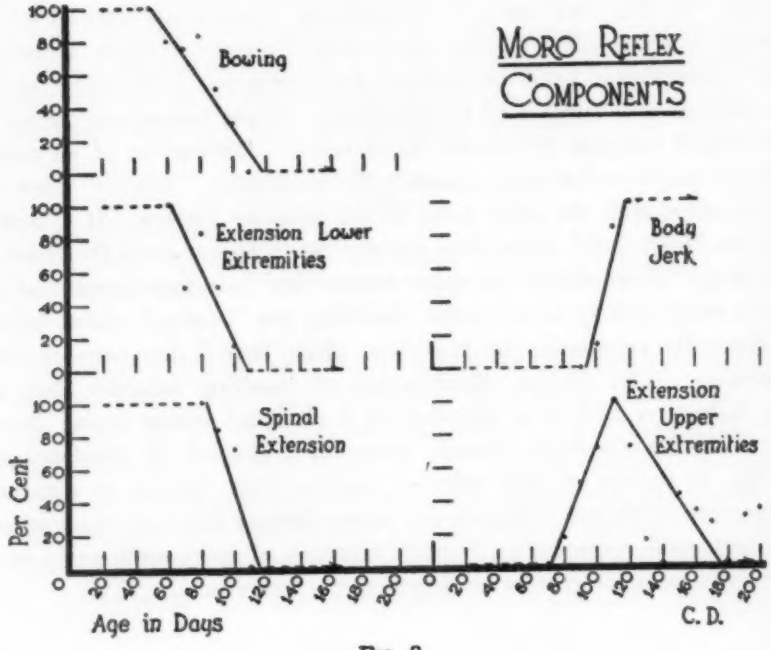
Moro Reflex Components
Bowing
Extension Lower Extremities
Body Jerk
Spinal Extension
Extension Upper Extremities
Per Cent
Age in Days
C. D.

Fig. 8

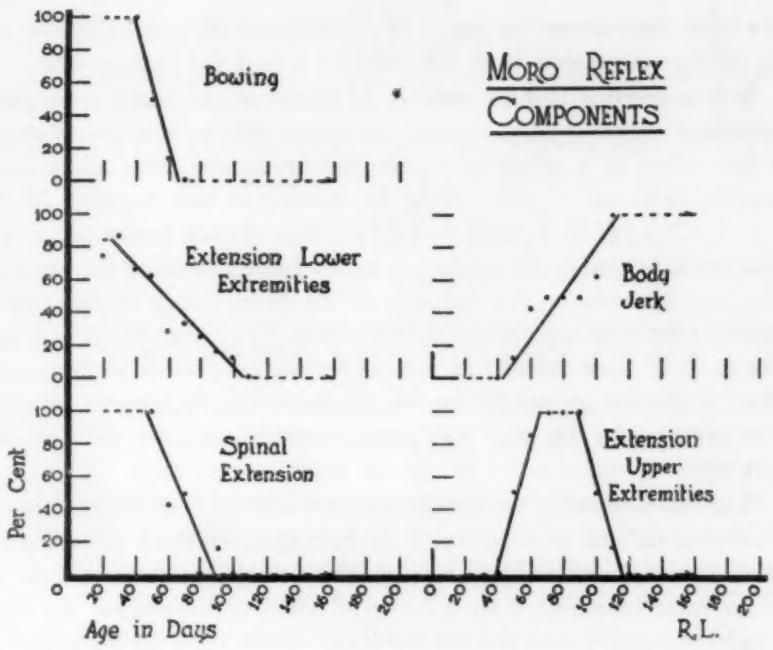

FIG. 9

When the same data are plotted, and straight lines drawn through, as in Figures 7, 8, and 9, not only are the periods of change clearly demonstrated, but the velocity or rate of change for each aspect of the behavior pattern can thereby be calculated. The velocity of change for the various components is given in the following table:

Percentage change per day, K, in components of the Moro reflex

	P. D.	C. D.	R. L.
Bowing	K 2.04	K 1.52	K 3.70
Extension of lower extremities	K 1.72	K 2.00	K 1.04
Spinal extension...	K 2.56	K 3.23	K 2.38
Body jerk	K 2.78	K 4.17	K 1.43
Extension of upper extremities	K +1.81 to —1.70	K +2.63 to —1.56	K +3.70 to —3.75

These values are not as precise as they appear to be because they are based upon lines drawn through the data by inspection.* It is however

*Calculations made by Weinbach.

safe to say that during the period of development the rate of change for any of the components is of the order of 1 to 4 per cent per day.

It is interesting that the velocity of change as calculated from these percentage curves is of essentially the same order as the rate of decay of the reflex as a whole when the determinations were made from quantitative measures representing the duration of each response (P. D. 2.73; C. D. 2.74; R. L. 2.68.) The duration of each response was ascertained by counting the number of movie frames showing the reaction. The data representing the duration of the Moro reflex in these three subjects have been interpreted by Weinbach (1). Analysis of behavior data so as to show velocity as well as periods of growth suggests considerable promise in elucidating the fundamental principles of behavior development. In this way also gross observational data are rendered more meaningful.

The curve showing the developmental trends of component parts of a behavior-pattern as manifested in individual children more clearly demonstrates the relationship between these components than do curves of the same components on a group of children (McGraw, 2), even though the group curves and the individual curves show the same general trend.

In exposing the relationship of component factors in a behavior-pattern the superiority of the longitudinal method is clearly demonstrated. The essence of the longitudinal approach is that it must embrace an analysis of factors which have entered into the composition of a given state, and also an analysis of the factors which develop out of these particular conditions. It is in fact an historical method. But it is more than a mere enumeration of items in chronological sequence.

When such a method as the one used in analyzing the development of the Moro reflex is applied to analysis of other behavior-patterns in the same child-subject, then significant relations between the development of different types of behavior will be better understood.

REFERENCES

1. WEINBACH, A. P.: Some Physiological Phenomena Fitted to Growth Equations 1. The Moro Reflex. HUMAN BIOLOGY (this number).
2. MCGRAW, M. B.: The Moro reflex. *American Journal of Diseases of Children.* Vol. 54, pp. 240-251 (1937).

SOME PHYSIOLOGICAL PHENOMENA FITTED TO GROWTH EQUATIONS
I. MORO REFLEX

BY A. P. WEINBACH

Normal Child Development Study of the Department of Diseases of Children, Columbia University, and the Babies' Hospital, New York

THE purpose of this paper and the papers to follow is to fit deliberately the observational data of some physiological phenomena, which change in some manner with age, to growth equations of the exponential type such as are found for the growth of bacteria, or cells, or populations, or body weight, etc. It is further the purpose of the writer to obtain mathematical expressions which not only describe the trend of the observed data, but which yield ideas about the nature of the phenomena in question.

One method of obtaining the mathematical expression describing a phenomenon is the derivation, from the fundamental physical relations of the system, of the analytical equations that adequately are to represent the phenomenon. The mathematical expressions thus obtained become the shorthand statements of the conditions surrounding the phenomenon, and are to convey the same thoughts that would otherwise be stated in a longer way by words. Whether the fundamental premise by which the mathematical expressions are obtained is reasonable or justified is left open and undiscussed, since we are concerned here only with the fitness of the equations obtained to the observed data and with the practical ideas which can be obtained by using the equations.

Data which are capable of being examined in this way are provided by observations on the duration of the Moro reflex in the same infant at different ages.* The Moro reflex refers in this paper to the body startle response elicited in infants by striking a sharp blow on the bed close to the baby's head.

McGraw (1) plotted a curve of the duration of the reflex in seconds against age for 57 infants at various ages and pointed out that there is a definite rise in

* Data for the duration of the Moro reflex obtained by M. B. McGraw.

the duration of the response during the first month. During the second month there is a sharp decline in duration, with a second rise during the third month. From the 90th day on there is a steady decline in duration until the 180th day.

Since the duration of the Moro reflex changes with age, it may be assumed that the change in duration is a manifestation of growth in the central nervous system. For the ends of mathematical analysis the simplest assumption which one can make is that the duration of the reflex in seconds, t, is directly proportional to the mass, m, of the tissue or cells in the nervous system involved in the reflex. The consequences of this assumption will be developed in the present paper. It is of course unlikely that the relationship between m and t can be so simple as one of direct proportionality but since no justification can be found for a more complicated relationship, the very simple assumption is preferable.

The data for this paper were obtained by daily (except Saturdays and Sundays) measurements of the reflex in seconds on three infants (two of whom were twins) for the first 200 days of life. The duration in seconds was obtained by photographing the infant during the startle response and subsequently counting the frames of the movie film. The counting was simplified by using a moviola in which a revolution counter is attached to the main drive pulley by means of a flexible shaft, the counter advancing once every time one frame passes the field of observation. The speed at which the film was driven through the moviola was controlled by a foot rheostat operated by the observer. A reversing switch allowed a change in direction of the film. The photographs were all taken at 32 frames per second so that a count of 32 frames represented one second duration of the reflex.

The assumption that direct proportionality exists between the duration of the reflex in seconds, t, and the mass, m, of the tissue or cells in the nervous system involved in the reflex is given by the equation

$$t = k_1 m \tag{1}$$

This mass, m, may be thought of as the difference between the mass of the nervous tissue tending to inhibit the reflex, W_1, and the mass of the nervous tissue tending to augment or maintain the duration of the reflex, W_2.

$$m = W_2 - W_1 \tag{2}$$

According to Tilney, taken from McGraw (1), there is an indication that subcortical nuclei are augmentory to the reflex while cortical cells are inhibitory. These two distinct areas of nervous tissue would cor-

respond to W_2 and W_1, respectively, in the preceding nomenclature. Since W_2 and W_1 are assumed to be masses of growing tissues, the rate of change of m with age is dependent on m or $W_2 - W_1$.

$$\frac{dt}{dA} = k_2 (W_2 - W_1) \tag{3}$$

Combining (1), (2) and (3), we have

$$\frac{dt}{dA} = \pm Kt \tag{4}$$

where $\frac{dt}{dA}$ represents the rate of change of the duration of the reflex with age; A, the age of the child in days; t, the duration of the reflex in seconds; and K is a constant. The minus sign would be inserted when the duration is falling and the plus sign when it is increasing. If W_1 is greater than W_2, the minus sign would automatically enter in, and if W_1 is less than W_2, the plus sign would be used.

Rearranging (4)

$$\frac{dt}{t} = \pm KdA \tag{5}$$

Integrating (5) we have

$$ln\ t = \pm KA + C \tag{6}$$

And from which

$$t = Be^{\pm KA} \tag{7}$$

In equation (7) t is the duration of the reflex in seconds; A is the age of the child in days; K is the time-rate of change of duration ($100K$ is the percentage change per day); B is a constant; and e is the base of natural logarithms, 2.718.

Although the change in duration may be either positive or negative depending on the relative growths of the nervous tissue tending to inhibit the reflex and of that tending to augment it, in general the duration declines with age. The entire phenomenon, therefore, is suggestively called the *decay of the Moro reflex.*

Fig. 1 is a plot of the duration of the Moro reflex in seconds as ordinates against the age of the child in days as abscissae. The duration in seconds was obtained as previously described by counting movie frames. The smooth curve through the data was obtained by plotting

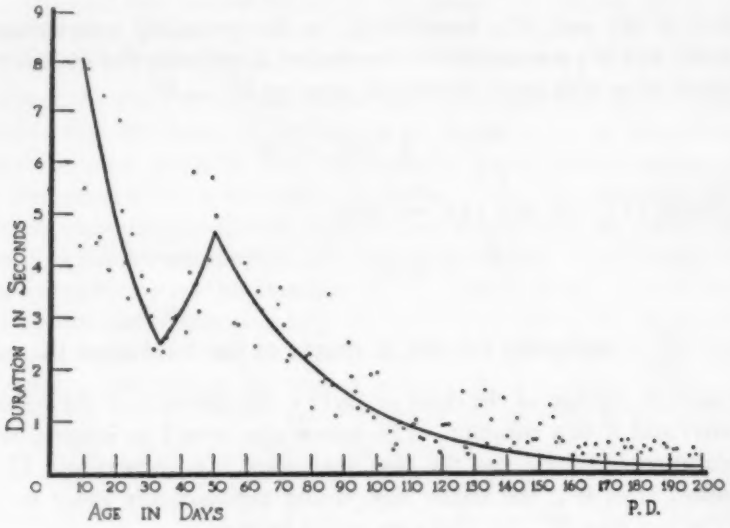

FIG. 1

ln t versus *A* (equation (6)) on semi-log paper, and from the values for *K* and *C* thus obtained for three segments of the curve, replotting equation (7) on cartesian coordinate paper. Equation (7) with these changes of constants seems to describe rather closely the observed data. The scatter of the actual data may be due to two causes: One, the observations of the duration of the reflex are insufficient to give a true average of the child's performance, since only one reflex was filmed and timed per day; and two, the counting of the frames may be subject to some variation due to inability of the individual counting frames to know exactly when motion due to the reflex has ceased. The latter seems to be the main cause of the scatter. Repeated counts of the same observations gave an average range of 0.87 seconds when the duration was of the order of 1.0 to 2.5 seconds, and an average range of 0.20 seconds when the duration was of the order of 0.7 seconds.

The points of interest in the curve of duration with age are, first, the time-rate of increase or decrease of duration, which may give a measure of the rate of growth of the tissue of the brain concerned with the reflex; and second, the age at which the duration curve shows an abrupt change which may give an indication of the age at which growth of the brain tissues concerned begins to occur.

From Fig. 1 it is assumed that during the first ten days of postnatal life a rapid growth of the tissue tending to inhibit the reflex begins and continues until about 30 to 40 days of life, at which time growth of the tissue tending to augment the reflex occurs. Then at about 50 days of life the relative growth of the tissue tending to inhibit the reflex is predominant and continues so until 120 to 130 days of life and possibly until the reflex has become stabilized, although at 120 to 130 days the duration does show a slight increase which may be real or which may be due to experimental error in counting the frames or determining the exact time the reflex ceases.

The value of K, the time-rate of decrease of the reflex, is obtained from the semi-log plots of duration versus age. From equation (7) it can be stated that the percentage decline in duration in seconds is 4.7 per cent per day from 10 to about 35 days; the percentage increase is 3.75 from about 35 to 50 days; and from then on the percentage decline is 2.73 per cent per day.

From the values of K we may determine the number of days required to double or halve the duration. Taking the initial value of K, 0.0474 (for P. D.) and dividing it into the natural logarithm of 2, 0.693, the duration is halved in 14.6 days. Assuming that during this period the

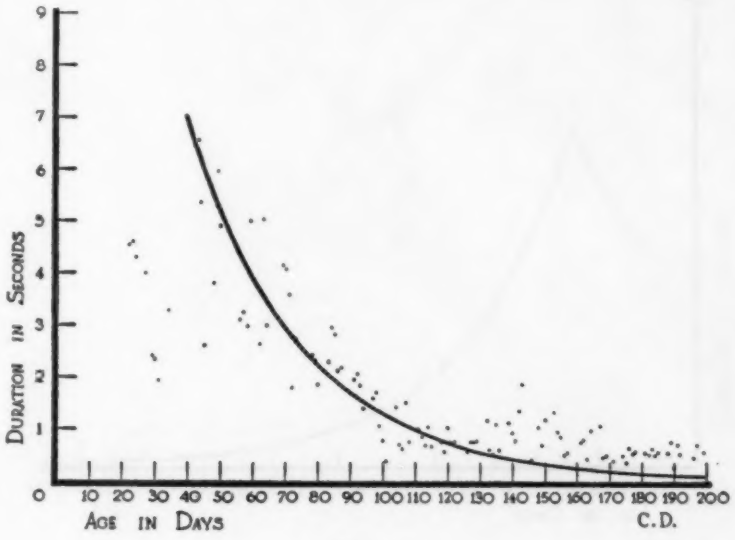

FIG. 2

duration is a measure of nervous tissue growth, it may be suggestively stated that it takes approximately 15 days for the difference between the mass of tissue in the brain tending to inhibit the reflex and that tending to augment it to double its weight or activity. Or if it is assumed that the activity is a measure of the number of active cells, then every 15 days during this period the number of cells maturing or becoming active or functional is just doubled.

Similarly, from about 35 to 50 days it would take 18.5 days at the prevailing rate for double the number of cells to become functional between the area tending to augment the reflex and that tending to inhibit it; and from 50 to 120 days it takes about 25 days for double the number of cells to become functional between the area tending to inhibit the reflex and that tending to augment it.

Unfortunately, the data for C. D. are incomplete for the first 40 days of life. However, from 40 days on the curve obtained (Fig. 2) is practically identical with that of the twin. The instantaneous percentage change in the duration of the reflex (from the smooth curve) is 2.74 per cent per day as compared with 2.73 for the twin.

In Fig. 3 the data of R. L. show a rise in the duration of the reflex from 15 to about 45 days with a rate of increase of 2.04 per cent per

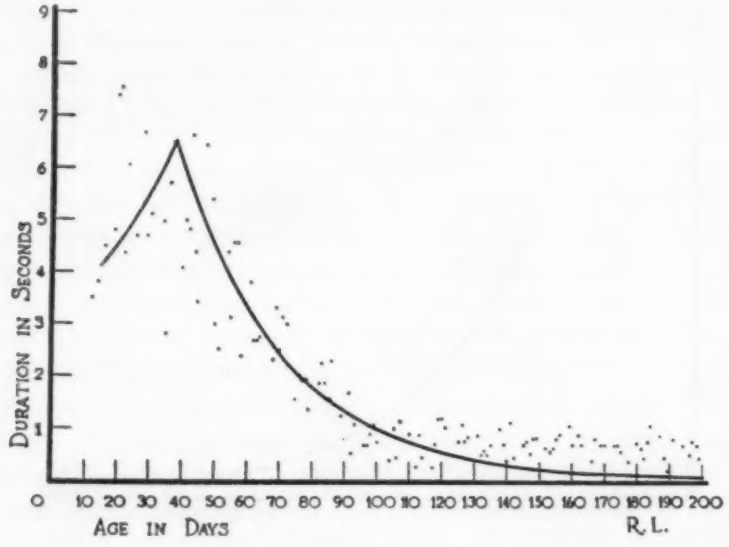

FIG. 3

day; and a fall in duration from 45 days on with a rate of decrease of 2.68 per cent per day.

No adequate anatomical or physiological explanation is at hand for the sharp points of inflection. Obviously, they are the natural outcome of the method used in fitting curves to the observed data.

SUMMARY

The change in the duration of the Moro reflex with age has been fitted to a growth equation.

REFERENCE

(1) McGraw, M. B.: The Moro reflex. *American Journal of Diseases of Children.* Vol. 54, pp. 240-251 (1937).

A MATHEMATICAL METHOD FOR STUDYING THE GROWTH OF A CHILD*

BY RACHEL M. JENSS[1] AND NANCY BAYLEY[2]

THIS report presents a method of describing quantitatively the growth of a child during the first six years of life. More specifically, the description is made in terms of the simple mathematical function, $y = c + dx - e^{a+bx}$, which may be used to study the growth of different characteristics in the same child and in different children.

Measurements of crown-heel length and weight[3] for two white children, a boy and a girl,[4] examined at irregular intervals from birth

* The authors are indebted to Doctor Herbert R. Stolz and Professor Harold E. Jones, of the Institute of Child Welfare, University of California, for advice during the progress of the study; and especially to Professor Lowell J. Reed, of the School of Hygiene and Public Health, Johns Hopkins University, who developed the method of describing growth presented in this paper and critically reviewed its application. Acknowledgment also is made to W P A project 4428 for clinical assistance.

[1] Research Fellow at the Institute of Child Welfare, University of California.

[2] Associate at the Institute of Child Welfare, University of California.

[3] Measurements were taken with the clothing removed. The techniques used in making these observations are based, with the following exceptions, on methods employed at the Iowa Child Welfare Research Station, the University of Iowa. (See: Iowa Child Welfare Research Station, State University of Iowa. (1931). *Amer. Jour. Dis. Child.*, 42, 1137-1143.) Weight: Infants under 20 pounds were weighed on a light portable spring scale which was checked at frequent intervals. Heavier children were weighed on a balance scale. As both instruments were calibrated in pounds and ounces, the readings were converted into kilograms for purposes of analysis. Length: Recumbent length (cm.) was measured under eighteen months of age, and then, standing length. A stadiometer calibrated in inches and quarter inches and manufactured by the Continental Scale Works, Chicago, was used for this purpose. See Bayley, Nancy, and Davis, F. C. (1935). Growth changes in bodily size and proportions during the first three years: A developmental study of sixty-one children by repeated measurements. *Biometrika*, 27, 26-87.

[4] The case histories of these children indicate that both of them may be classified as the leptosome type of build—broad shoulders, slightly concave scapulae,

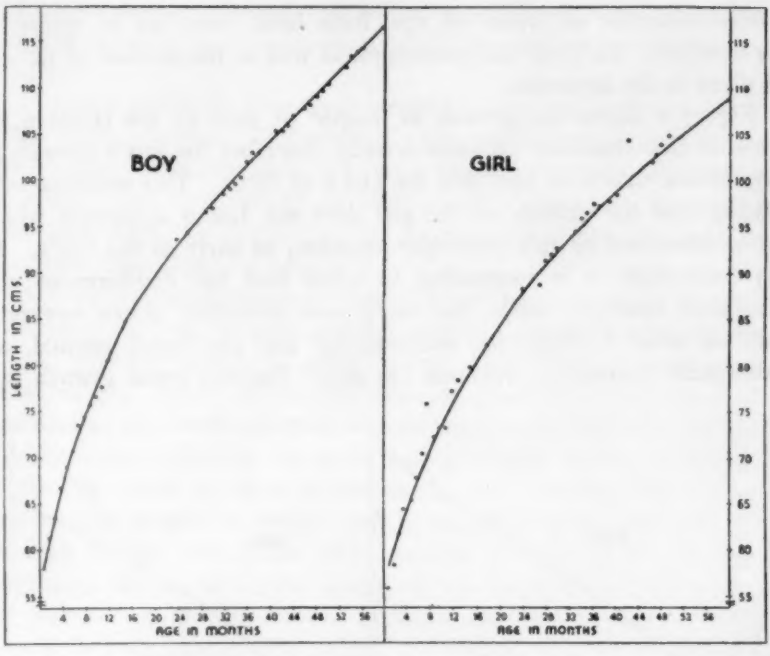

FIG. 1. THE GROWTH IN LENGTH OF A BOY AND A GIRL, OBSERVED AT IRREGULAR INTERVALS DURING THE FIRST 60 MONTHS OF LIFE, EXPRESSED IN TERMS OF THE EQUATIONS,

$y = 79.434 + 0.615x - e^{2.188 - 0.106x}$ and $y = 80.962 + 0.471x - e^{2.233 - 0.0699x}$

narrow hips, and a small amount of subcutaneous tissue—although the girl's appearance was more typical than the boy's.

They have the usual history of childhood diseases: The girl suffered from a number of colds during the first three years and after that age, her tonsils showed evidence of chronic infection; the boy had occasional colds during the first four years. Later on he also gave a history of infected tonsils. Nevertheless, the physician repeatedly rated the girl's nutritional status as below average. On the other hand, the boy's nutrition shifted from markedly above at 21 to average at 60 months of age.

There is one other difference between these two children, which is important in evaluating the particular method of studying growth outlined in this paper: The girl's "development" was about average, but the boy's was rated consistently above average during the total period he was under observation.

to approximately six years of age, have been described in terms of this equation. Its form and properties, as well as the method of fit, are are given in the appendix.

Figure 1 shows the growth in length[5] of each of the children, in terms of this function. It satisfactorily describes the boy's growth as early as one month of age; and the girl's, at three. This evidence may indicate that the growth of the girl does not follow a pattern which can be described by this particular equation, as early as the boy's. In this connection, it is interesting to know that her development was considered average; while the boy's was definitely above average.[6] Both of these findings, the mathematical and the developmental, together with Scammon's evidence (p. 205)[7] that the foetal growth rate

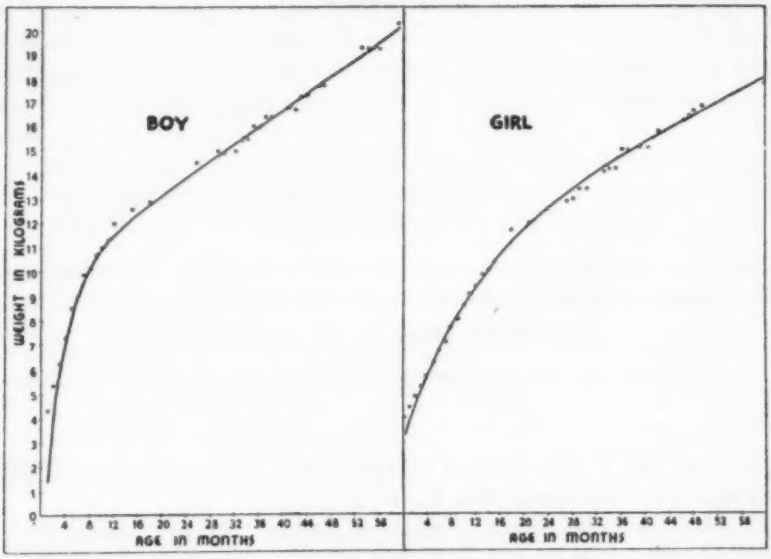

FIG. 2. THE GROWTH IN WEIGHT OF A BOY AND A GIRL, OBSERVED AT IRREGULAR INTERVALS DURING THE FIRST 60 MONTHS OF LIFE, EXPRESSED IN TERMS OF THE EQUATIONS,

$y = 9.564 + 0.175x - e^{2.500 - 0.343x}$ and $y = 10.415 + 0.124x - e^{1.997 - 0.0858x}$

[5] Length as referred to in this paper is crown-heel length.

[6] Based on physical examinations made by a physician.

[7] Harris, J. A., Jackson, C. M., Patterson, D. G., and Scammon, R. E. (1930). The Measurement of Man. University of Minnesota Press, *Minneapolis*. Pp. vii and 215.

may persist during a variable period in early infancy raise the question: Can this equation, $y = c + dx - e^{a+bx}$, be used to estimate a child's maturity?

Figure 2 shows the growth in weight of these two children, in terms of the same function. Unfortunately the question of the age at which this equation first describes the observations cannot be answered for the reason that such factors as feeding and elimination, etc. were not controlled, with the result that the measurements are relatively more inaccurate than those for length.[8]

Special interest attaches to Figure 3 which describes the same data in terms of the first derivative of the equation, expressed as a percentage of its integral value.[9] In other words, this form of the equation measures the child's percentage rate of growth per month. More specifically, the boy's relative increase in length and also in weight is much more rapid than the girl's during infancy and early childhood; on the other hand, his rates decline much more sharply. The difference between his growth in weight and in length is larger than the girl's, although by the time either child reaches the age of 60 months the percentage increase in weight is only slightly larger than the corresponding increase in length. These findings—the boy's more rapid early growth in both characteristics, and the greater percentage increase in weight than in length, especially in the boy—may be evaluated along with clinical judgment of growth and development, in relation to the growth constant, e^b, of the equation, $y = c + dx - e^{a+bx}$.

This parameter, e^b, is a pure number, independent of scale. It measures the acceleration of growth for any given month, $(n + 1)$, in terms of the acceleration for the preceding month, (n):

$$\frac{d^2y}{dx^2}_{(n+1)} \Big/ \frac{d^2y}{dx^2}_{n} = e^b.$$

It can therefore be used to compare the growth of several characteristics in one child and in different children.

The values of this constant, e^b, are shown in the following table for the length and weight of the boy and the girl.

Examination of these growth constants shows a difference between the growth in weight and length of each child; that is, the ratio of the

[8] The error of measurement was not estimated for either weight or length.

[9] $z = \frac{dy}{dx}/y = \frac{d - be^{a+bx}}{c + dx - e^{a+bx}}$

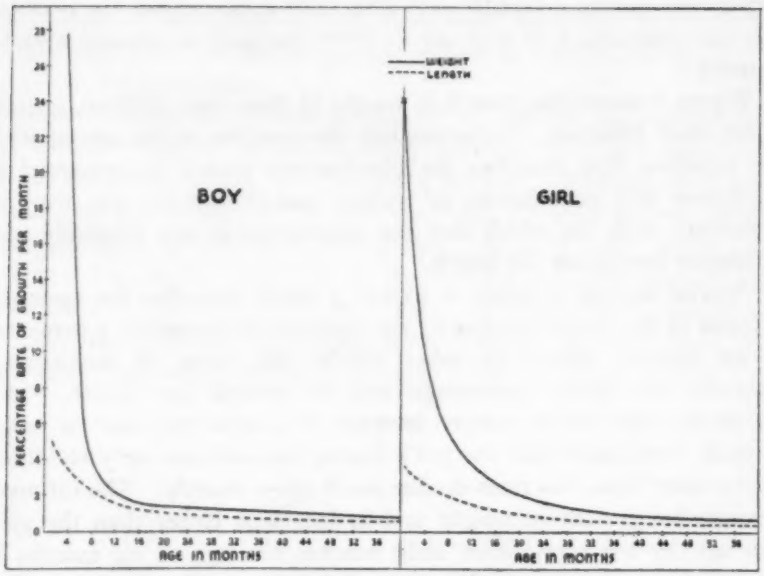

FIG. 3. PERCENTAGE RATE OF GROWTH PER MONTH OF A BOY AND A GIRL, OBSERVED AT IRREGULAR INTERVALS DURING THE FIRST 60 MONTHS OF LIFE

acceleration of growth in weight at two successive months is smaller than growth in length, especially for the boy. In addition, it may be noted that both of the girl's growth constants are larger than the corresponding ones for the boy. In other words, there is a consistent difference in the value of the acceleration factor for weight and length, which varies with sex.

TABLE 1

The growth constant, e^b, for the length and weight of a boy and a girl, each observed from birth to 60 months of age

ANTHROPOMETRIC CHARACTERISTIC	GROWTH CONSTANT, e^b	
	Boy	Girl
Crown-heel length	0.898	0.933
Weight	0.708	0.918

The biological significance of these findings may be determined by fitting the equation to measurements on a number of children observed repeatedly during the first six years of life; by comparing the values of the constant, e^b, for height, for weight, for height and weight, and then studying them in relation to selected criteria of growth and development. In other words, there is the possibility that the growth constant, the parameter, e^b, of the equation, $y = c + dx - e^{a+bx}$, may prove useful in longitudinal studies of the growth of the child. For example, such questions as the following can be investigated:

What is the variation in this constant for several or more characteristics of the same child? Is it less than the variation of the same characteristics in different children? Does it have any biological significance; For example, does it vary with race? Can it be used to estimate a child's maturity? In other words, the acceleration constant may furnish a stable, sensitive criterion of development to be used for measuring the effect of various environmental and biological factors on the growth of the individual child.

SUMMARY

The growth of two anthropometric characteristics, length and weight, of each of two children, a boy and a girl, observed at irregular intervals during the first six years of life, is described satisfactorily by the equation, $y = c + dx - e^{a+bx}$.

The application of this technique to longitudinal growth data has one specific advantage over other methods in the literature; namely, the determination of an important characteristic of growth, the acceleration factor, e^b.

This growth constant may be used to compare several characteristics in one child and in different children and to evaluate the factors which influence development during infancy and childhood.

APPENDIX

The equation, $y = c + dx - e^{a+bx}$.

Parameters

In the equation,

$$y = c + dx - e^{a+bx}, \qquad (1)$$

the constants, c, d, and e^a, are dimensional; the parameter, e^b, is a pure number. It measures the acceleration when $x = (n + 1)$, in terms of the acceleration when

$x = n$; that is, the acceleration at any instant, $(n + 1)$, is e^b times its value at n, for

$$\frac{dy}{dx} = d - be^{a+bx}, \tag{2}$$

$$\frac{d^2y}{dx^2} = -b^2e^{a+bx}, \tag{3}$$

and

$$\frac{d^3y}{dx^3} = -b^3e^{a+bx}. \tag{4}$$

Therefore,

$$\frac{d^2y}{dx^2}_{(n+1)} \Big/ \frac{d^2y}{dx^2}_{n} = e^b, \tag{5}$$

and

$$\frac{d^3y}{dx^3} \Big/ \frac{d^2y}{dx^2} = b. \tag{6}$$

Method of fit

Let

y_0, y_1, y_2, y_3, be 4 equidistant values of y

and

0, 1, 2, 3, the corresponding values of x.

Substituting in (1):

$$y_0 = c - e^a \tag{7}$$

$$y_1 = c + d - e^{a+b} \tag{8}$$

$$y_2 = c + 2d - e^{a+2b} \tag{9}$$

$$y_3 = c + 3d - e^{a+3b}. \tag{10}$$

Subtracting:

$$(y_1 - y_0) = d - e^a(e^b - 1) \tag{11}$$

$$(y_2 - y_1) = d - e^{a+b}(e^b - 1) \tag{12}$$

$$(y_3 - y_2) = d - e^{a+2b}(e^b - 1). \tag{13}$$

Similarly,

$$(y_2 - y_1) - (y_1 - y_0) = -e^a(e^b - 1)^2 \tag{14}$$

$$(y_3 - y_2) - (y_2 - y_1) = -e^{a+b}(e^b - 1)^2. \tag{15}$$

Dividing:

$$\frac{(y_0 - y_2) - (y_2 - y_1)}{(y_2 - y_1) - (y_1 - y_0)} = e^b. \qquad (16)$$

Substituting in (14) gives e^a; in (11) gives d; and in (7), c.

These values of the constants, c, d, e^a and e^b, may be refined by the least squares procedure.[10]

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[10] Merriman, M. (1911). A Textbook on the Method of Least Squares. 8th. ed. John Wiley and Sons, Inc., *New York*. pp. viii and 230.

A MENSTRUAL RECORD DURING THE MENOPAUSE

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IT HAS been common practice to think and speak of puberty or the menopause as a single definite point in the life of an individual. Puberty and menarche frequently have been used as synonyms, although many now regard puberty as a process of development. In relation to time puberty is an area in the life of an individual in which menarche is only a readily determinable point.

The phenomena of attainment and stabilization of menstrual function was spoken of by Hartmann as a "stairstep" phenomena in relation to the monkey. Since menstruation is a cyclic function, requiring the synchrony of several endocrine factors, as well as other vascular and systemic functions it is to be expected that in girls these functions develop rhythmic sequence only over a period of time. Earlier studies on girls have shown that only after about 40 menstrual cycles is a really mature rhythm established. (Engle and Shelesnyak).

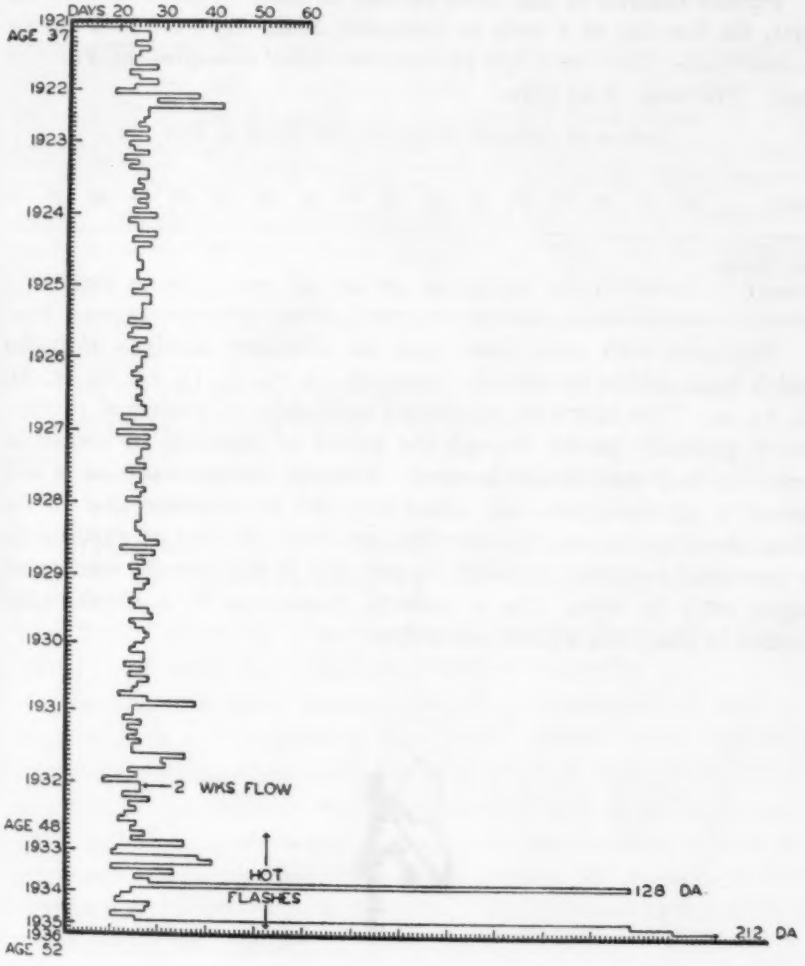
Rhythmic menstrual function is dependent on one, two, or more anterior pituitary hormones, at least two ovarian hormones, and other physiological factors, as well as a normal reactivity of ovaries and uterus.

If such a function is attained slowly during development, it might be suspected that it would be lost slowly. Every physician is well aware of this protracted process of involution. If rhythmicity develops slowly, with physiological ripening of organs and perfection of homeostatic mechanisms, one at a time, so it might be expected that menstrual efficiency would be lost over a period of time. If, as frequently suspected, the adolescent period is characterized by frequent anovulatory cycles, so it might be expected that the later years of life also may show an increased frequency of anovulatory cycles. Regarding this we have no data.

As a result of a similar remark in a lecture, a most interesting menstrual history was received from a member of the audience. The nature of the records and history bear every evidence of complete authenticity, and is herewith presented with confidence.

The data are graphically presented in Fig. 1.

D. T. F. Born Oct. 5th, 1884. Science teacher, unmarried. "I am not absolutely sure if the first period came the summer before I was 13 or 14, but I think before I was 13. I know that it did not appear again for 5 or 6 months."



Menstrual records were kept, since 1921, on calendars. "I was most curious to know just what would happen to me while going through the menopause. But I haven't missed 5 days from school altogether during all of the five years."

In February 1933 appear the first notes—"All indications of beginning on 13th but finally arrived on 18th"—March, "necessary to wear napkin from 23rd but really arrived on 31st." February 14, 1935, M. period "but very little and faint." August 18, 1936, "again the very faintest indications." "Hot flashes began in December 1932 and have continued ever since except during periods. Flashes very, very regular. At times every 40 minutes, never lasting more than 3 minutes. At other times flashes seemed to come every 2 hours."

Further analysis of data gives nothing unusual. From February 14, 1921, the first day of a cycle to December 22nd, 1932, the first day of another cycle, there were 173 periods, the cycles averaging 24.99±4.47 days. The mode is 24 days.

Indices of cycles in relation to the length in days

Days	18	19	20	21	22	23	24	25	26	27	28	29	30	31	35	36	42
No. Occurrences	1	1	1	7	14	23	36	31	29	13	9	1	1	1	2	2	1

Beginning with 1921, there were the following numbers of cycles which began within the calendar year; 13, 13, 15, 15, 15, 15, 15, 15, 14, 14, 15, 14. This case with remarkable uniformity of menstrual rhythm, which gradually passed through the period of cessation of menstrual function, is of considerable interest. Although the phenomenon is well known to gynecologists, the writer has seen no previous case in the literature where accurately recorded data show the loss of rhythmicity in menstrual function. It might be said that in this case the menopause began early in 1932. As in puberty, menopause is a physiological process in time—not a point, nor a date.

CONCERNING A RECENTLY REPORTED FINDING ON THE PHYSICAL GROWTH OF BOYS

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A STUDY by Hardy and Hoefer was published in 1936 under the title, *Healthy Growth: A Study of the Influence of Health Education on Growth and Development of School Children* (5). In view of the public interest in "healthy growth"; the number of aspects of physical, mental, and personality growth investigated by the study; and the fact that the report of the study takes the form of a book, it appears probable that the publication will have an extensive circulation. Should this be the case, its findings will become widely known and one may expect to see frequent reference made to them.

One of the findings on physical growth which receives definite emphasis by Hardy and Hoefer is as follows:

> "In the case of boys, the mean trend of the curves showed relatively large annual increments between 10 years and 11 years, which might be termed 'maxima points' of their growth curves during this period." (5, p. 120)

The "period" referred to at the close of the quotation is the entire age period under study, i.e. from 8 years through 14 years.

The finding is based upon an analysis of anthropometric data accumulated from measurement of "215 Joliet, Illinois, white boys"—each child being measured annually for at least three consecutive years (5, pp. 76-77). Quantitative support of the finding is furnished by a table (5, p. 79) which gives means at annual intervals, together with absolute increment values derived from these means, for stature, bi-deltoid diameter, and bi-trochanteric diameter. The pertinent figures from this table, specific for boys, are:

MEAN AGE	CASES	*Stature* MEAN	*Stature* ANNUAL INCREMENT	*Bi-deltoid diameter* MEAN	*Bi-deltoid diameter* ANNUAL INCREMENT	*Bi-trochanteric diameter* MEAN	*Bi-trochanteric diameter* ANNUAL INCREMENT
8½	29	49.3	..	11.5	..	8.8	..
9½	122	51.2	1.9	11.8	.3	9.1	.3
10½	176	52.8	1.6	12.2	.4	9.4	.3
11½	177	54.8	2.0	12.6	.4	9.8	.4
12½	105	56.1	1.3	12.9	.3	10.1	.3
13½	39	57.4	1.3	13.2	.3	10.3	.2
14½	16	58.6	1.2	13.4	.2	10.6	.3

It will be noted that the so-called "maxima points" reached at the age interval 10½—11½ years have increment values of 2 inches for stature and .4 inch for shoulder width and hip width.

Among the more important of the numerous other studies which have analyzed stature data covering the same age span are those of Bowditch (2) on Boston school children; Boas (1) on Toronto school children; Smedley (8) on school children of Chicago; Porter (7) on school children of St. Louis; Clark, Sydenstricker, and Collins (3) on school children of Maryland, North Carolina, South Carolina, and Virginia; and Gray and Ayres (4) on private school children of California, Illinois, Massachusetts, and New York. For boys, the following stature values are reported by these authors:

Mean Age	*Cases*	*Mean*	*Gain*	*Cases*	*Mean*	*Gain*	*Cases*	*Mean*	*Gain*
				(*Centimeters*)					
	BOWDITCH			BOAS			SMEDLEY		
8½	1481	121.3	...	934	121.7	...	255	123.4	...
9½	1437	126.2	4.9	905	126.6	4.9	228	128.9	5.5
10½	1363	131.3	5.1	839	131.4	4.8	254	133.0	4.1
11½	1293	135.4	4.1	817	135.7	4.3	228	137.0	4.0
12½	1253	140.0	4.6	746	140.1	4.4	256	141.8	4.8
13½	1160	145.3	5.3	596	145.3	5.2	230	148.8	7.0
14½	908	152.1	6.8	387	151.0	5.7	250	154.6	5.8

Mean Age	*Cases*	*Mean*	*Gain*	*Cases*	*Mean* (*Centimeters*)	*Gain*	*Cases*	*Mean*	*Gain*
		PORTER			CLARK *et al.*			GRAY AND AYRES	
8	2223	119.1	...	904	123.9	...	147	131.1	...
9	2205	124.4	5.3	889	128.8	4.9	167	135.8	4.7
10	2087	128.9	4.5	973	133.6	4.8	173	141.2	5.4
11	1819	133.8	4.9	871	137.9	4.3	201	145.4	4.2
12	1653	138.2	4.4	781	142.7	4.8	247	150.3	4.9
13	1268	142.9	4.7	679	147.4	4.7	293	156.4	6.1
14	925	148.6	5.7	471	153.2	5.8	373	162.4	6.0

It is evident that these studies consistently show greater annual gain for the age intervals of around 8-9 years and 13-14 years than for the age interval of approximately 10-11 years.

The writer has in progress an analysis of stature data obtained exclusively from repeated annual measurement of the same series of subjects. The data were accumulated on school children of Beverly and Revere, Massachusetts, by the Harvard Growth Study. Since the measurements were made at exactly one-year intervals, it is possible to obtain annual increment values for each child and to determine the mean annual increment for the group at successive ages. Absolute increment means (in centimeters) have already been computed for 157 boys of North European descent and eighty boys of Italian descent. These are as follows:

MEAN AGE INTERVAL	*North European*		*Italian*	
	CASES	MEAN ANNUAL INCREMENT	CASES	MEAN ANNUAL INCREMENT
8 to 9	153	5.38	79	5.24
9 to 10	155	5.13	80	5.03
10 to 11	157	4.87	80	4.86
11 to 12	157	4.90	80	4.90
12 to 13	157	5.74	80	5.55
13 to 14	157	6.58	80	6.65

The trend of the mean annual increments clearly declines from 8-9 years to 10-11 years and then rises to 13-14 years. This finding for a longitudinal study of stature is in general agreement with that for each of the six cross-sectional studies cited. It appears, then, that there is a preponderant number of analyses for stature which yield a completely reverse finding to that reported by Hardy and Hoefer (5).

Studies reporting means for bi-deltoid diameter of shoulders and bi-trochanteric diameter of hips over the age period from around 8-14 years are less numerous. Manuel (6) gives means for Mexican boys attending Texas schools which show annual gains for bi-deltoid diameter of 1.2 cms, for the interval 8½—9½ years, .9 cms. for the interval 10½—11½ years, and 1.6 cms. for the interval 13½—14½ years. The gains in bi-trochanteric diameter for the same age intervals are 1.1 cms., 1.0 cms., and 1.4 cms., respectively. Means for Iowa City boys in attendance at the University of Iowa elementary and high schools have been reported by the writer (7). These means yield annual increments of 1.0 cms. for 8-9 years, .9 cms. for 10-11 years, and 1.6 cms. for 13-14 years in bi-deltoid diameter and of 1.0 cms., .8 cms., and 2.1 cms. for corresponding age intervals in bi-trochanteric diameter. Obviously, the findings from each of these studies articulate with the studies on stature.

SUMMARY

Hardy and Hoefer (5) find that in the case of boys aged 8 through 14 years there are "relatively large annual increments between 10 years and 11 years, which might be termed 'maxima points'..." (p. 120). The trend of the evidence from other investigations definitely supports the opposite finding, i.e. that when compared with the increments for 8-9 years or 13-14 years there are "relatively small annual increments between 10 years and 11 years, which might be termed minima."

The reader is cautioned that the foregoing is intended to constitute no more than the critical evaluation of a single finding. It carries no implications with reference to the scientific value of the numerous other findings reported by Hardy and Hoefer.

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RECENT LITERATURE

USEFUL IN THE STUDY OF HUMAN BIOLOGY

In this department will be noticed the books and reprints which are currently received at the Editorial Office. Publications intended for notice here should be addressed to Dr. Raymond Pearl, Department of Biology, School of Hygiene and Public Health, 1901 East Madison Street, Baltimore, Maryland, U. S. A.

I. EVOLUTION AND GENETICS

1. *Evolution—General Principles*

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